REPORT RESUMES

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AN INVESTIGATION OF THE IMPROVEMENT OF EDUCATIONAL FILMSTRIPS AND A DERIVATION OF PRINCIPLES RELATING TO THE EFFECTIVENESS OF THESE MEDIA--STUDY III.

BY- VANDERMEER, A.W. MONTGOMERY, ROBERT
PENNSYLVANIA STATE UNIV., UNIVERSITY PARK

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PHASE THREE OF A STUDY TO DETERMINE THE EFFECT OF REVISED FILMSTRIPS ON PRODUCING SIGNIFICANT LEARNING BEHAVIOR WAS REPORTED. THE FILMSTRIP, "THE EARTH'S SATELLITE, THE MOON," WAS SHOWN TO SUBJECTS FROM GRADES 5, 6, 8, 10, 11, AND 12. A MULTIPLE-CHOICE TEST WAS DEVELOPED TO COVER THE PICTORIAL AND VERBAL CONTENT OF THE FILMSTRIP. REVISED AND ORIGINAL SHOWINGS WERE MADE TO THE GROUPS. THE EFFECTIVENESS OF THE REVISION WAS MADE ON THE BASIS OF MEAN TEST SCORES ON CONTENT. THE RESULTS INDICATED THAT HIGHER SCORES WERE OBTAINED FOR THE REVISED VERSION THAN FOR THE ORIGINAL AND THAT THE REVISED VERSION APPEARED TO RESULT IN SIGNIFICANTLY MORE LEARNING AT ONE OR MORE GRADE LEVELS. PHASES ONE AND TWO OF THIS STUDY WERE ASSIGNED ACCESSION NUMBERS ED 003 533 AND ED 003 535 RESPECTIVELY. (RS)

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AN INVESTIGATION OF THE IMPROVEMENT OF EDUCATIONAL FILMSTRIPS AND A DERIVATION OF PRINCIPLES RELATING TO THE EFFECTIVENESS OF THESE MEDIA, PHASE 3 REV. OF

PHASE III REVISION OF
FILMSTRIP – EARTH'S SATELLITE

U.S. Office of Education Grant No. 736049

A. W. VanderMeer
Robert Montgomery

College of Education
The Pennsylvania State University
University Park
Pennsylvania

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AN INVESTIGATION OF THE IMPROVEMENT OF INFORMATIONAL FILMSTRIPS AND THE DERIVATION OF PRINCIPLES RELATING TO THE IMPROVEMENT OF THIS MEDIA

STUDY NUMBER III

A. W. VanderMeer
Professor of Secondary Education

R. E. Montgomery
Graduate Assistant in Education

The Pennsylvania State University
University Park, Pennsylvania

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CHAPTER I

INTRODUCTION AND OVERVIEW

It has been observed that filmstrips intended to teach factual content fall somewhat short of complete effectiveness.[1] Similar observations have been made relative to other pictorial illustrations.[2]

The purpose of the present research was to determine the extent to which systematic study of pictorial and graphic materials in filmstrips and their accompanying verbal captions could be translated into revisions of these filmstrip elements in such a way that the revised filmstrip would produce significantly more learning than the original. To the extent that such improvements could be effectuated, theoretical principles might emerge.

A subsidiary purpose of the study was to demonstrate a procedure whereby research workers might cooperate with filmstrip producers and public school people in the improvement of filmstrip materials.

The general procedure used in the study was as follows:

(1) An informational filmstrip of general curricular validity was selected. The content had to be such as to be useful from upper elementary grades through high school. Such a filmstrip was the one used in the study; namely, "The Earth's Satellite, The Moon", produced by the Society for Visual Education.

(2) As many four-choice multiple choice items as possible were written to cover the pictorial and verbal content of the filmstrip. Pictorial and graphic representations were used as needed in [illegible] items.

VanderMeer, A. W., "Relative Contributions to Factual Learning of Pictorial and Verbal Elements of a Filmstrip." School Review, 58:84-89.

Spaulding, Seth, "Communication Potential of Pictorial Illustrations." Audio-Visual Communication Review, 4:31-46.

(3) The test items appearing to have greatest face validity were administered to populations from grade 5 to grade 12, and a revised test was developed on the basis of statistical analyses of responses to the original items.

(4) On the basis of the proportions passing given test items or groups of items, and through an examination of the distractors that attracted a significant number of responses, it was possible to identify frames and captions that appeared to be relatively ineffective in communicating the information that they contained.

(5) Based on the data mentioned in (4) and on the basis of experience, intuition, and imagination, the investigator and his assistants developed hypotheses as to how the original filmstrip (hereinafter referred to as FSO) could be revised so as to improve its communicative effectiveness without changing its informational content.

(6) In a conference between the investigator and his assistants, the producers,[1] the educational consultant employed by the producer, and a filmstrip artist, decisions were made as to what revisions would be accomplished.

(7) After the artist had prepared rough approximations of the revisions, the investigators checked the revisions to see that the changes agreed upon were clearly made.

(8) A revised filmstrip, hereafter referred to as FSR, was prepared by the producer.

(9) The revised and original filmstrips were shown to randomly constituted halves of population samples ranging from upper elementary

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[1] John C. Kennan and Walter Johnson, Society for Visual Education, Inc., 1345 Diversey Parkway, Chicago 14, Illinois

to senior high school levels under controlled experimental conditions, and the filmstrip test was administered. Each group saw only the revised or the original, never both.

(10) Judgments as to the effectiveness of the revision were made on the basis of mean test scores on content covered in both the original and revised filmstrips and on the basis of differences in proportions passing individual test items covering information presented in both original and revised frames.

SUMMARY OF RESULTS

1. The revised version produced mean test scores that were higher than those produced by the original, significant at the 2.5 per cent level for junior high students, and at the 1 per cent level for senior high students. The difference was non-significant at the upper elementary grade level. The over-all improvement was from about 2 to 5 per cent in terms of average scores. Mean percentage scores ranged from 67 per cent for fifth graders who saw the original filmstrip to 81 per cent for eleventh graders who saw the revised filmstrip.
2. The revised filmstrip produced significantly higher proportions (5 per cent level) passing twenty-three of seventy-nine items, with a median difference of .20 in proportions passing and a range of differences of .10 to .53.
3. On three items a statistically significant higher proportion passed at all grade levels after seeing the revised version. In six other items, the difference in proportions passing favored the revised version at two grade levels and in the case of fourteen items a significantly higher proportion at one grade level passed after seeing the revised filmstrip.
4. On five items, one grade level of students achieved significantly higher proportion passing after seeing the original version than did those who saw the revised version.
5. Revisions were made in twenty-eight of thirty-one frames used. In fifteen cases the revision appeared to result in significantly more learning at one or more grade levels as measured by one or more test items. In one case, the revised frame appears to have produced significantly less learning on one test item at one grade level.

REVISIONS THAT SEEMED SUCCESSFUL

The kinds of revisions that were made in the experimental filmstrip can be characterized and described in the abstract. These descriptions may serve a useful purpose in summary form, but the student of the filmstrip will do well to examine and analyze the detailed data that follows in subsequent sections of this report. The characterizations of the revisions are frankly arbitrary.

Pictorial and Graphic Revisions

Three types of revision of the pictorial or graphic element of the filmstrip seemed to "pay off" rather consistently. In most cases, efforts to increase the iconicity of a frame were rewarded by greater proportions of subjects passing items based on the frame. For example, one frame in the original used two discs to explain the waxing moon -- one to show, in high contrast, how the moon would appear from the earth, and a second to show its position and the portion of it receiving sunlight. In the revision, a single moon showing only the brilliant crescent and the less brilliant earthlit moon was used.

A second type of revision that seemed successful was the multiplication of cues through the addition of redundant elements of different kinds but with the same informational content. An example is a frame intended to introduce an explanation of the moon's phases. In the original, the moon was shown in four positions around its orbit. In the revision, four more positions were added, and numbers were interspersed to show how long it takes the moon to go from one position to the next.

A third type of revision that resulted in more subjects learning the content presented was the addition of directional arrows and increasing the prominence of them in some cases.

Other attempted revisions were usually associated with superior results, yet did not yield consistently positive effects. Among these were labeling objects, grouping like objects in such a way as to make it easy to estimate the number of them, separating elements into separate frames as distinguished from split frame projection, plan views instead of perspectives, the use of dimension lines to clarify size comparisons, and attention directing arrows.

Revisions of Verbal Captions

Perhaps it is our overwhelmingly greater experience with words that explains the fact that the investigators could conceive of fewer revisions of the verbal content of the filmstrip than they could for the graphic and pictorial, and that a greater proportion of these revisions "paid off". Six such revisions were "successful" in the majority of the cases, and three more were partially successful. This contrasts with the graphic and pictorial revisions for which the corresponding numbers are three and twelve.

One type of revision was similar to a revision of the pictorial and graphic element; namely, the use of redundancy or repetition in captions containing what is believed to be relatively unfamiliar material. For an example, one caption regarding the phases of the moon reads, in the original,

> "In about one week we see 1/2 of its lighted side in the south at sunset. It is at FIRST QUARTER one-fourth of the way around the earth."

The revised caption reads, "About one week after the new moon we see 1/2 of its lighted side in the south at sunset....." The remainder of the caption was identical to the original. In addition, the dates of September 1 and September 7 were added to the picture at the point of the orbit at which the new and first quarter moon would appear, and the caption "one week" was added between the two.

On two occasions, the captions were such as to suggest substituting a presumably "stronger" word in the filmstrip revision. On one occasion the word "larger" replaced the word "large". On another, the original caption began, "Actually the dark patches are...." In the revision, the caption was changed to begin, "You can see in this telephotograph that the dark patches are...."

Succinctness seemed to "pay off" on occasion. Or, perhaps, in the argot of the programmer, a decrease in size of step might better describe the modifications in question. In any event, superior results were obtained by splitting the caption on the original, which read,

> "The WANING moon grows smaller during the second two weeks. It is seen late at night and in the early morning hours before sunrise."

The revision cut the original caption in two, and also improved the technical accuracy of the caption, as follows:

> "The WANING moon becomes less full each night during the second two weeks," and
>
> "The WANING moon is seen late at night and in the early morning before sunrise."

Usually the original filmstrip employed capital letters to emphasize key nouns. When this was not done, it was possible to try out underlining in the revision. This form of emphasis met with success. Interestingly enough, on the one occasion when capitalization was added to the revision, every group showed higher proportions passing the critical item, but the differences were not statistically significant.

Conclusions

It obviously should not be assumed that the foregoing modifications will or will not "pay off" in any and all situations. Far more intensive study of childrens' cognative and affective reactions to pictorial material and related verbal captions is needed. It is quite possible that some of the positive results obtained come from combinations of factors. Some were perhaps fortuitous. Some "non-results" may be attributable to faulty application of valid principles; others to faulty principles.

This research does show, however, that the study of such stimulus materials as appear in filmstrips can result in improvements in the communication effectiveness of these media. The study also demonstrates the feasibility of collaboration between commercial producers and University researchers in projects such as the one reported herein.

CHAPTER II

CONDUCT OF THE STUDY

General Procedure

Subjects: Subjects in this study were pupils in the fifth, sixth, eighth, tenth, eleventh, and twelfth grades. Alternative versions of the filmstrips were randomly assigned to subgroups which on subsequent testing, proved to be substantially equivalent on the basis of intelligence, opinion of teachers as to the group's ability, and to socio-economic level of the community and school.

Some characteristics of the populations are shown in Table 1.

Date Gathered and Methods Used: Original and revised versions of the filmstrip were compared (1) in terms of proportions passing individual items and clusters of items (for each frame), (2) proportions selecting key item distractors, and (3) total mean test scores. The groups shown the original filmstrip version were considered as the control groups. The revised version was shown to experimental groups. A two-tailed test was used for assessing the significance of proportions passing items on the FSO and FSR achievement tests.

An analysis of the observed differences in proportions passing individual items as they related to information presented in individual frames was the source of hypotheses for the modification of the filmstrip original. Students and teacher interviews also were used to aid in the interpretation of the test results relating to filmstrip caption and "pictures".

TABLE 1

A Description of the Pupils Used for each Phase of the Investigation

PHASE	GRADE	N	AGE	MALE	FEMALE	DATE OF TESTING
1. Test Validation and Collection of Filmstrip Revision Data	5	48	8-11	33	15	9/14/60
	8	60	12-15	29	31	9/13/60
	10,11	44	15-17	22	22	9/22/60
2. Collection of Comparison Data--Immediate Testing						
A. Original Filmstrip						
	5,6	66	10-13	31	35	2/23/61; 3/29/61
	8	79	13-16	44	35	3/1/61; 3/29/61
	10,11, 12	69	15-19	40	29	2/20/61; 3/2/61
B. Revised Filmstrip						
	5,6	70	10-13	30	40	2/23/61; 3/29/61
	8	81	13-15	44	37	3/1/61; 3/29/61
	10,11, 12	67	15-19	33	34	2/20/61; 3/2/61

TOTAL N-- 544

The derivation of mean scores and standard deviations as a basis for assessing total group learning constituted one statistical analysis. The significance of differences of proportions passing and failing individual items was used for assessing the effectiveness of the various frames of the filmstrip.

Experimental Procedure

The investigation was conducted in two phases. The method, nature, and source of participating groups will be described in each phase.

Phase I: Validation of the Testing Instrument and Collection of Filmstrip Revision Data

A factual four-choice multiple choice test was constructed to test the acquisition of information presented in the pictures and captions of the filmstrip. In order to achieve greater validity in some test items, actual photographs were used to test pictorial material. The first version of the test was administered on September 13, September 14, and on September 22, 1960, to 152 pupils in the Coatesville City Schools. The groups consisted of 58 from grade five, 60 from grade eight, and 44 from grade ten and eleven.

Grade five was tested in one group in a multi-purpose room in an elementary building. Grade eight was tested in two sections of 30 each in a regular classroom in the junior high school. Grade ten and grade eleven were tested in regular classrooms in the senior high school building. In each testing situation the special pencils, answer sheets, and testing instruments were placed on each pupil's desk before the group entered the room. The testing instrument was turned printed side downward and left in this position until after the first frame of the filmstrip had been shown. There were teachers in attendance in each group to aid in the testing procedure. Separate groups of questions were answered after each frame of the filmstrip had been exposed for approximately 15 seconds, including time for the proctor to read aloud any captions that appeared.

After the students had entered the room and the investigator's assistant was introduced, the students were given the following information. "I am going to show you a filmstrip entitled 'Earth's Satellite--The Moon', produced by The Society for Visual Education. I think you will learn some interesting information from the filmstrip. The procedure will be somewhat different from other filmstrips which you have seen. After I have shown the first frame of the filmstrip, I will direct you to a page of test questions in the booklet which is turned printed side down on your desks. Do not write on the test booklet but record your answer on the special answer sheet which you should take now and fill in your name and the other information required on the top of the test sheet." (Explanation was given as to the use of the special pencils and IBM answer sheets. These directions and a sample question printed on the answer sheet were discussed with the students.)

"As each frame is projected I will read the caption or printed sentences appearing on each one. You should follow the reading silently and then study very carefully the pictorial material and the printed material on each frame. You will have fifteen seconds to try to learn all you can from each frame after I have read the caption. I will then instruct you to turn to the test page covering that frame. This test will tell me what you have learned from each frame. Be sure to read carefully every question and all of its possible answers before deciding which is the correct one. Does anyone have a question about what he is to do? You will have time to answer each of the questions, but you will not be able to turn back and redo any questions."

The total time for the test was approximately sixty minutes for grades eight, ten, and eleven. For grade five the time was approximately seventy-five minutes. This difference in time arises because of the slower rate at which the elementary students answered the questions. All students were given adequate time to respond to each item.

The data from the Coatesville City Schools was used for validating the testing instrument, using item analysis. Table 2 shows the proportion of the upper and lower 27 per cent passing each item in each grade. Questions which were found to be too difficult, poorly constructed, or ambiguous were revised. The test used to compare the original and revised filmstrip versions consisted of 79 items. Reliability coefficients of the test used in the research ranged from .81 to .86 (Kuder-Richardson Formula 21)

Revision of Filmstrip: The second purpose for which data from the preliminary test was used was to indicate which frames of the filmstrip were not communicating adequately. Low proportions passing were presumed to be indicative of what pupils did not learn from each frame of the filmstrip. Table 3 summarizes the proportion passing each item by grade level. These data formed the basis of a conference

TABLE 2

Phase 1 data utilized in validating the achievement tests administered in Phase 2. Item analysis consisted of comparisons of item difficulty expressed as proportions of the top and bottom twenty-seven per cent of pupils passing each item.

ITEM	GRADE 5 (N=58)		GRADE 8 (N=60)		GRADE 10, 11 (N=44)	
	Upper Per Cent	Lower Per Cent	Upper Per Cent	Lower Per Cent	Upper Per Cent	Lower Per Cent
1.	85	54	94	44	92	84
2.	85	46	100	63	92	76
3.	85	46	88	44	68	56
4.	100	85	100	68	100	92
5.	92	54	100	56	100	16
6.	100	92	100	94	100	100
7.	100	100	100	82	100	84
8.	100	85	100	69	92	84
9.	92	46	100	81	100	84
10.	85	54	94	31	76	24
11.	100	62	100	50	100	84
12.	62	54	100	31	68	32
13.	38	46	88	19	92	24
14.	92	85	100	68	100	92
15.	100	85	100	74	100	84
16.	77	54	88	75	100	60
17.	85	31	94	56	84	84
18.	69	31	88	56	100	68
19.	92	62	100	88	92	84
20.	92	46	94	88	84	76
21.	77	46	88	68	92	76
22.	92	46	100	68	92	84
23.	100	62	100	100	100	100
24.	100	69	100	100	100	100
25.	92	46	100	100	100	100
26.	69	23	100	63	92	84
27.	54	15	94	68	92	84
28.	92	38	100	88	100	70
29.	92	23	100	68	100	60
30.	69	23	94	68	76	76
31.	69	38	100	81	76	76
32.	77	31	100	87	92	84
33.	69	54	100	56	92	84
34.	100	38	100	94	100	84
35.	85	38	100	81	100	100
36.	85	8	100	50	100	84
37.	92	54	94	81	100	84
38.	85	46	100	87	100	84
39.	92	54	100	63	100	70
40.	100	54	100	100	100	100

TABLE 2
(continued)

Phase 1 data utilized in validating the achievement tests administered in Phase 2. Item analysis consisted of comparisons of item difficulty expressed as proportions of the top and bottom twenty-seven per cent of pupils passing each item.

ITEM	GRADE 5 (N=58)		GRADE 8 (N=60)		GRADE 10, 11 (N=44)	
	Upper Per Cent	Lower Per Cent	Upper Per Cent	Lower Per Cent	Upper Per Cent	Lower Per Cent
41.	69	23	88	63	92	76
42.	85	23	94	63	92	70
43.	85	31	88	63	68	68
44.	77	15	100	81	100	76
45.	54	8	88	31	100	16
46.	46	31	41	37	24	16
47.	69	31	82	37	68	68
48.	100	54	88	68	92	76
49.	38	23	81	50	76	50
50.	31	31	25	19	24	32
51.	69	23	100	88	92	92
52.	46	38	94	63	76	68
53.	92	8	94	94	100	92
54.	23	38	75	19	32	16
55.	54	15	76	44	40	32
56.	46	15	76	68	92	100
57.	100	69	88	100	100	100
58.	100	77	100	100	100	100
59.	15	23	24	13	32	16
60.	54	15	82	50	76	60
61.	69	23	82	63	92	60
62.	92	38	100	88	92	76
63.	85	46	94	88	92	84
64.	85	8	100	68	92	68
65.	92	15	94	88	92	76
66.	77	23	82	68	92	76
67.	62	38	100	63	92	50
68.	92	23	100	68	92	84
69.	92	8	100	88	100	92
70.	62	31	100	63	76	84
71.	69	54	94	75	100	24

TABLE 3

Phase I data used to revise PSO. Total correct responses are expressed as proportions passing each item. Low percentages and high percentages were interpreted as indicating frames of the filmstrip that were related to a specific item and which were or were not learned by the pupil.

	GRADE				GRADE				GRADE		
ITEM	5	8	10, 11	ITEM	5	8	10, 11	ITEM	5	8	10, 11
1	70	73	84	27	46	84	82	53	58	94	95
2	63	86	82	28	67	90	89	54	25	53	27
3	69	75	73	29	56	88	86	55	32	45	30
4	94	88	95	30	50	83	80	56	35	73	95
5	73	71	55	31	46	91	80	59	13	23	25
6	98	96	32	32	52	96	93	60	40	65	70
7	98	90	93	33	65	81	75	61	42	73	76
8	94	86	61	34	65	92	95	63	69	90	84
9	71	92	93	35	60	91	100	64	59	85	86
10	71	65	50	36	48	85	84	65	47	92	77
11	81	77	93	37	75	85	86	66	52	83	86
12	63	73	61	38	60	91	80	67	52	83	77
13	33	61	68	39	60	89	80	68	67	92	80
14	94	88	96	40	79	98	100	69	52	92	95
15	92	92	93	41	40	78	80	70	41	84	75
16	71	84	82	42	54	81	70	71	58	88	74
17	58	70	84	43	56	75	68				
18	52	81	80	44	40	91	82				
19	81	94	93	45	25	68	66				
20	69	90	86	46	40	35	25				
21	63	82	86	47	37	53	64				
22	67	88	93	48	67	75	89				
23	79	96	98	49	31	62	66				
24	85	100	98	50	27	27	27				
25	69	100	100	51	46	86	89				
26	44	84	89	52	38	79	68				

in which the details of the filmstrip revision were decided.

The filmstrip was revised through cooperative efforts between the investigators and personnel of the Society for Visual Education, Chicago, Illinois, the producers of the original filmstrip. Those participating in the revision conference were Mr. Walter A. Johnson, Vice-President and Educational Director, Society for Visual Education; Mr. Paul Rosenau, Director of Industrial Production, Society for Visual Education; Dr. A. W. VanderMeer, Professor of Education and Associate Dean, College of Education, The Pennsylvania State University; and Robert E. Montgomery, Graduate Assistant to Dr. VanderMeer. In order to insure the exact changes as specified at the conference in the revised filmstrip, the material before being photographed was sent to The Pennsylvania State University where the pictorial and verbal material were verified and some changes made. These suggested changes before production are in Appendix II. The changes are characterized and the related frames are identified in Tables 4A and 4B. Frames in which revisions produced some significant differences are underlined.

Specific changes can be understood best, however, by comparing the revised and original filmstrip frame by frame as shown on pages 114 to 123.

TABLE 4A

Revisions by Frames (Pictorial)

Revision	Original Frame Number
Label an object	*1*, 4
Increase iconicity	*1*, 4, 5, *8*, *11*, 12, *13*, *15*, *16*, *17*, *18*, 19, *20*, *24*
Group like items for easy estimate of quantity	2
Correct technical error	2, *18*
Change 0 to None	2
Separate frames instead of split frames	3
Plan view instead of perspective	4
Bigger labels	4
Lines for size comparison	4
Remove irrelevant details	7
Divide "packed" frame into two or more	*9*, 10
Multiply learning cues through redundancy	*11*, *15*, *16*, *18*, 19, 20, 25
Addition of direction arrows	15, 16, 17, 18, 19, 20
Make direction arrow more prominent	*1*, *11*
Add attention directing arrows	27, 30, 31

Note: In Tables 4A and 4B frame numbers underlined are those in which a significantly greater proportion of those seeing the revised filmstrip (FSR) passed the relevant test items.

TABLE 4B

Revisions by Frames (Verbal)

Revision	Original Frame Number
Underline important word or phrase	1
Capitalize important word or phrase	21
Change word and phrase "strength"	
"Both seem same size"	6
"The two seem same size"	
Change "large" to "larger"	8
Change 3rd person to 2nd person	24
Relate less familiar to more familiar	9, 15
Multiply learning cues through redundancy	9, 15
Succinctness	10, 17
Correct technical errors	17, 20, 25, 29

Phase II: The Collection of Comparison Data on Original and Revised Filmstrips

In January and February 1961, original and revised versions of the filmstrip and the associated test were administered to populations at Chief Logan Joint Schools and Kishacoquillas Junior-Senior High School near Lewistown, Pennsylvania. Classes were divided in halves by randomly assigning boys and girls to one of two groups, and assigning filmstrip versions to these reconstituted groups by the flip of a coin. A schedule of presentation times and proctor assignments was established to control the proctor variable and the time of presentation as much as possible. In order to insure that the two proctors used identical procedures, a dry run of each version of the filmstrip was performed in grade five of the College Area Schools on January 25 and 26, 1961. Each proctor observed the other to make certain the material was presented identically.

In collecting the comparison data, proctor number one showed the original filmstrip version to one group consisting of one half of each of two classes. Proctor number two at the same time showed the revised filmstrip version to the other halves of the same classes. For the next showing, the proctors exchanged the filmstrips they were using, with proctor number two showing the original version to the next groups. Similarly, the same proctor would show one original version and one revised version in each of the other grade levels tested. No two groups of students saw both filmstrip versions.

An effort was also made to control for the factor of fatigue of proctor and of student groups in each grade. The fatigue factors were arbitrarily given values of 1 and 2 in order to control for fatigue of pupil-viewer and also for fatigue of the investigator-tester. The number 1 represents either a morning viewing and testing session or only one session for the day. The number 2 represents either an afternoon viewing and testing session or any second session on a given day. The total fatigue factors for all FRO groups was 15, equaling the total fatigue factors of 15 for all FSO groups.

The proctor variable factors were arbitrarily given values of 1 and 2 in order to control the groups for effects of different proctors. The number 1 represents the same proctor as does the number 2 always represent the other proctor. The total effects of proctor variables for all FSO groups was 9, equaling the total proctor factors of 9 for all FSR groups. Table 5 shows how the groups and proctors were scheduled to balance these factors.

TABLE 5

EQUATING GROUPS FOR VARIABLE EFFECTS OF TWO DIFFERENT PROCTORS ADMINISTERING FILMSTRIP VERSIONS

Immediate Testing, Kishacoquillas and Chief Logan Joint

GRADE & SECTION		FILMSTRIP VERSION	FATIGUE OF PROCTOR	PROCTOR VARIABLE	PUPIL FATIGUE FACTOR	TOTAL VARIABLE FACTORS
5a	6b	FSR	2	1	2	Upper Elementary
5a	6b	FSO	2	2	2	FSO 10
5c	6d	FSR	2	2	1	FSR 10
5c	6d	FSO	2	1	1	Junior High
8a	8b	FSO	1	1	1	FSO 7
8a	8b	FSR	1	2	1	FSR 7
8c	8d	FSR	1	1	1	Senior High
11a	12a	FSO	1	1	1	FSO 7
11a	12a	FSR	1	2	1	FSR 7
10c	12b	FSO	1	2	1	
10c	12b	FSR	1	1	1	

Total proctor variable factor is 9 in FSO and FSR combined groups.
Total fatigue variable factor is 15 in FSO and FSR combined groups.

RESULTS AND EVALUATION

A comparison between versions of the filmstrip was made in terms of mean total test scores. Table 6 shows the mean test scores and the statistical analysis for this comparison. In grade five there was no significant difference in mean test score achievement. However, in grade eight there was a difference in mean score in favor of the revised version, which was significant at the .025 level. In grades 10, 11 and 12, the difference in favor of the experimental group was significant of the .01 per cent level of confidence.

A second comparison was made in terms of proportions passing each item. Items in which the difference in proportion passing was significant at the .05 per cent level are listed in Table 7. In grade five the yield was eight items with significant differences favoring the FSR. In grade eight there were 16 items with significant differences in favor of the FSR. In the group composed of grades 10, 11, and 12, there were 11 items with significant differences showing an improvement for the FSR.

Table 7 also shows the items that were eliminated from the phase II achievement test which were not pertinent to the revision. The remainder of the table shows the items on the testing instrument on which there were significant in favor of the FSR for each grade level.

There were four items significantly different in favor of FSO in grade five, and one item in favor of FSO in grade eight, as shown in Table 8. These items will further be discussed in the evaluation of each frame.

The proportions passing each test item for the FSO and FSR are shown by grades in Table 9.

This data will be utilized in the frame by frame discussion of the revision which will follow.

TABLE 6 - Statistical Analysis of the Data Showing Comparisons Between FSO and FSR
Earth's Satellite--The Moon
Population and Achievement Data

	GRADE 5			GRADE 8			GRADE 10, 11, 12		
	FSO		FSR	FSO		FSR	FSO		FSR
Total correct answers	3517		3839	4433		4830	4231		4352
Mean for achievement scores	53.29		54.84	56.11		59.63	61.32		64.95
Reliability of achievement test	.81		.83	.84		.88	.81		.86
Mean for intelligence scores	106.26		107.97	100.85		102.54	100.06		97.27
Standard deviation for achievement scores	9.39		9.76	9.74		10.66	8.37		8.87
Standard deviation for intelligence scores	12.47		10.64	11.46		12.35	13.58		13.29
SE of Means for achievement	1.156		1.166	1.096		1.184	1.007		1.084
Standard error of the difference between FO and FR achievement scores		1.642			1.613			1.479	
SE of Means for intelligence	1.535		1.232	1.289		1.372	1.635		1.624
Standard error of the difference between FO and FR intelligence scores		1.968			1.882			2.304	
Achievement score "t"		.944			2.182*			2.45**	
Intelligence score "t"		.869			.898			1.21	
Pearsons r; intelligence versus achievement	.5632		.3207	.4688		.2939	.4935		.3253
Range for achievement scores	29-73		29-74	25-73		36-78	31-74		43-78
Range for intelligence scores	76-145		85-132	68-128		73-132	73-137		71-137
Degrees of Freedom		134			158			134	
N	66	136	70	79	160	81	69	136	67

*Significant .025 level
**Significant .01 level

TABLE 7

Test Items on Which Significantly Different Proportions Passed

Original Versus Revised Filmstrip

Four items eliminated from Phase II achievement test as not pertinent to the revisions	Twenty-two items showing significant differences in favor of FSR for one or more grade levels		Eight items showing significant differences in favor of FSR over FSO for grade five		Sixteen items showing significant differences in favor of FSR over FSO for grade eight		Eleven items showing significant differences of FSR over FSO for grades ten, eleven, and twelve	
24	1	47	1	61	1	45	1	61
25	2	49	30	66	2	47	30	76
65	27	50	49	78	27	49	33	
69	30	51	53		30	50	43	
	31	53	55		31	51	45	
	33	55			34	55	51	
	34	56			41	78	53	
	41	61			42		55	
	42	66			44		56	
	43	78						
	44							
	45							

TABLE 8

Items on Which There Were Significant Differences in Proportions Passing in Favor of the Original Filmstrip

IMMEDIATE TESTING

GRADE	5	8	11
Item	9	39	0
Number	26		
	50		
	73		

* As determined by a significance of difference between correct response proportions for FSO and FSR (Two-tailed test)

TABLE 9

Proportions Passing Items and Significance of Differences in Proportions Passing in FSO and FSR Groups

	GRADE 5 (N=136)		GRADE 8 (N=160)		GRADE 10, 11, 12 (N = 133)	
ITEM	FSO	FSR	FSO	FSR	FSO	FSR
1	56	(76)*	63	(78)	70	(91)
2	68	64	66	(80)	75	85
3	61	71	63	77	76	81
4	92	93	89	93	93	93
5	64	53	64	73	61	49
6	97	93	97	96	87	91
7	82	89	87	95	90	88
8	89	96	92	94	84	87
9	(94)	74	76	86	90	84
10	62	49	61	58	58	57
11	88	90	94	91	88	82
12	50	52	62	48	72	64
13	44	46	60	64	72	64
14	71	57	73	65	75	76
15	95	86	92	93	100	96
16	89	90	90	95	97	99
17	85	91	96	93	93	93
18	52	66	68	67	70	76
19	18	17	30	40	49	40
20	80	83	85	91	90	94

( ) Significant at .05 level or better
( )* Significant at .01 level or better

TABLE 9
(continued)

	GRADE 5 (N=136)		GRADE 8 (N=160)		GRADE 10, 11, 12 (N=133)	
ITEM	FSO	FSR	FSO	FSR	FSO	FSR
21	82	88	92	88	94	91
22	45	54	75	67	78	78
23	79	87	89	84	86	91
24	97	94	95	95	99	100
25	100	96	99	98	97	99
26	(89)*	76	87	95	99	94
27	65	59	70	(86)	81	88
28	52	60	58	69	66	66
29	75	74	79	88	86	94
30	68	(84)	76	(90)	81	(94)
31	53	37	35	(58)	61	57
32	62	61	71	70	75	79
33	50	64	71	80	62	(85)
34	80	79	76	(95)	90	94
35	94	86	91	84	97	94
36	85	77	84	84	96	93
37	65	56	76	65	75	73
38	80	74	85	90	90	88
39	80	71	(86)	69	86	82
40	79	83	90	88	93	90
41	54	44	56	(72)	75	73

( ) Significant at .05 level or better

( )* Significant at .01 level or better

TABLE 9
(continued)

ITEM	GRADE 5 FSO	GRADE 5 FSR	GRADE 8 FSO	GRADE 8 FSR	GRADE 10, 11, 12 FSO	GRADE 10, 11, 12 FSR
42	52	61	50	(67)	71	76
43	44	54	46	53	46	(67)
44	68	80	63	(78)	88	88
45	48	56	38	(60)	47	(65)
46	47	57	49	59	51	67
47	39	50	29	(46)	41	53
48	88	90	76	85	88	90
49	48	(76)	61	(84)	72	85
50	(68)	51	49	(68)	70	73
51	30	46	33	(63)	44	(72)
52	53	47	52	63	65	63
53	77	(93)	82	90	87	(97)
54	68	54	61	68	67	78
55	20	(49)	33	(53)	22	(75)
56	48	64	48	58	59	(82)
57	83	74	84	83	93	96
58	53	54	64	74	68	78
59	58	70	67	73	75	85
60	88	83	86	88	84	94
61	23	(39)	38	51	32	(83)
62	29	26	27	22	41	37

( ) Significant at .05 level or better
( )* Significant at .01 level or better

TABLE 9
(continued)

ITEM	GRADE 5 FSO	GRADE 5 FSR	GRADE 8 FSO	GRADE 8 FSR	GRADE 10, 11, 12 FSO	GRADE 10, 11, 12 FSR
63	62	69	72	74	77	82
64	70	81	73	84	86	91
65	97	96	99	98	100	100
66	64	(86)	78	83	77	88
67	44	57	61	60	72	76
68	58	61	68	69	86	79
69	88	90	91	96	99	96
70	77	84	86	90	97	100
71	83	75	80	81	91	97
72	79	70	82	75	93	91
73	(74)*	47	72	64	86	87
74	76	71	77	80	90	93
75	88	93	92	94	93	99
76	58	59	72	72	62	(81)
77	86	88	90	88	99	95
78	51	(76)	55	(77)	75	82
79	73	84	76	82	94	89

( ) Significant at .05 level or better
( )* Significant at .01 level or better

CHAPTER III

THE REVISIONS TO PICTURE AND CAPTION

EARTH'S SATELLITE - THE MOON

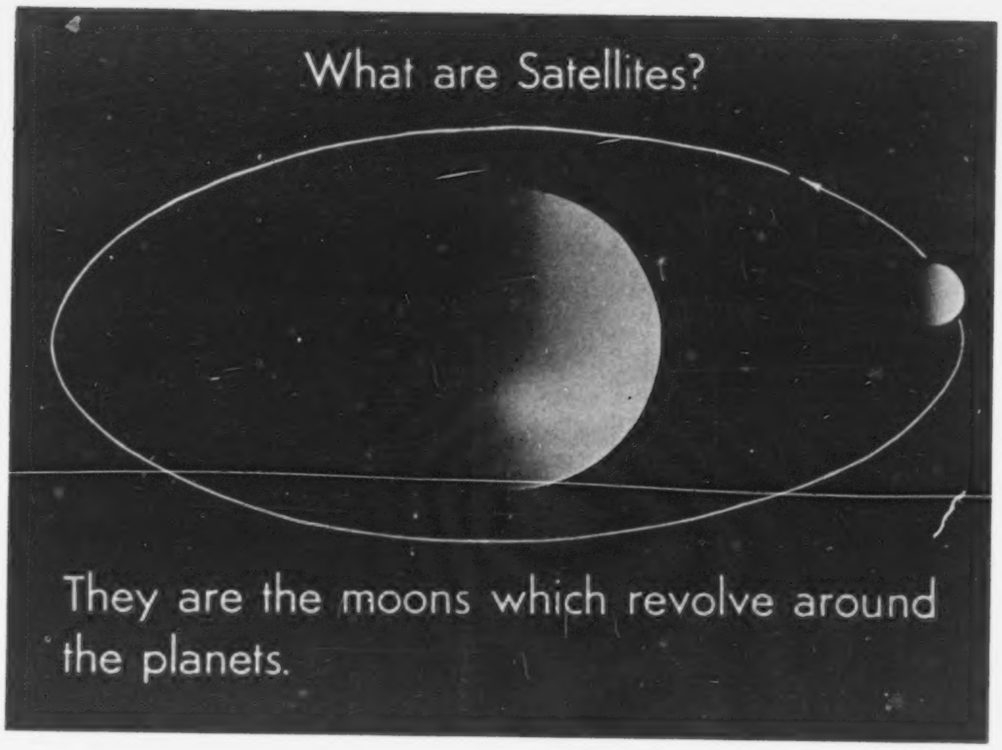
Frame #1

It was hypothesized that the addition of an identifying label, "satellite" would improve the effectiveness of the frame. It was also hypothesized that the revolution of the satellite around its planet, which is an identifying characteristic, would be more effectively communicated by making the directional arrows more prominent.

Item 1 shows a significant improvement in all three grades tested in favor of the revision. The subjects apparently learned what part of the diagram was not a satellite.

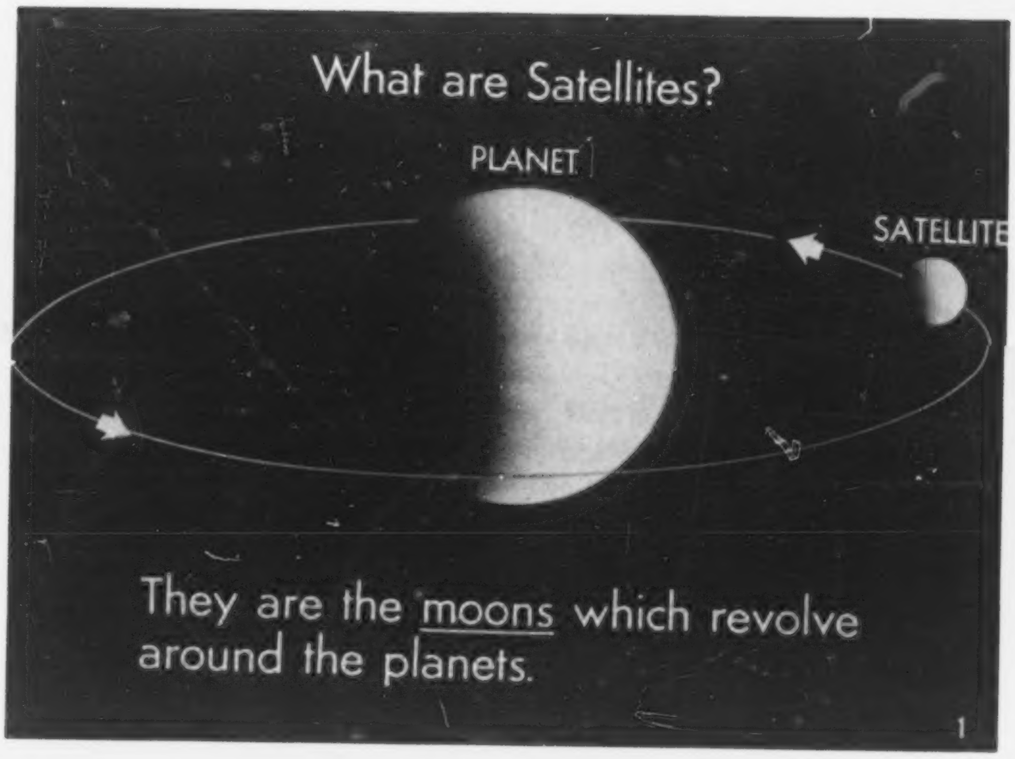
Item 2 dealing with the terminology of the satellite shows a significant improvement in grade eight which may also have resulted from the reinforcing of the labeling in the pictorial content.

Item 3 tests recall of the direction of the satellite's revolution. It would appear that the use of larger directional arrows would result in greater recall on this point. The students viewing the revised version did do better on Item 3, but only in the case of the eighth grade students was the difference statistically significant.



What are Satellites?

They are the moons which revolve around the planets.



What are Satellites?

PLANET
SATELLITE

They are the moons which revolve around the planets.

Frame #2

The procedure for showing Frame 2 varied somewhat from most other frames. After the proctor read the caption, a projection pointer was utilized in pointing out each planet with the following commentary:

"Mercury, the smallest planet, has no satellite."

"Venus has no satellite."

"Earth has one."

"Mars has two."

"Jupiter, the largest planet, has twelve satellites."

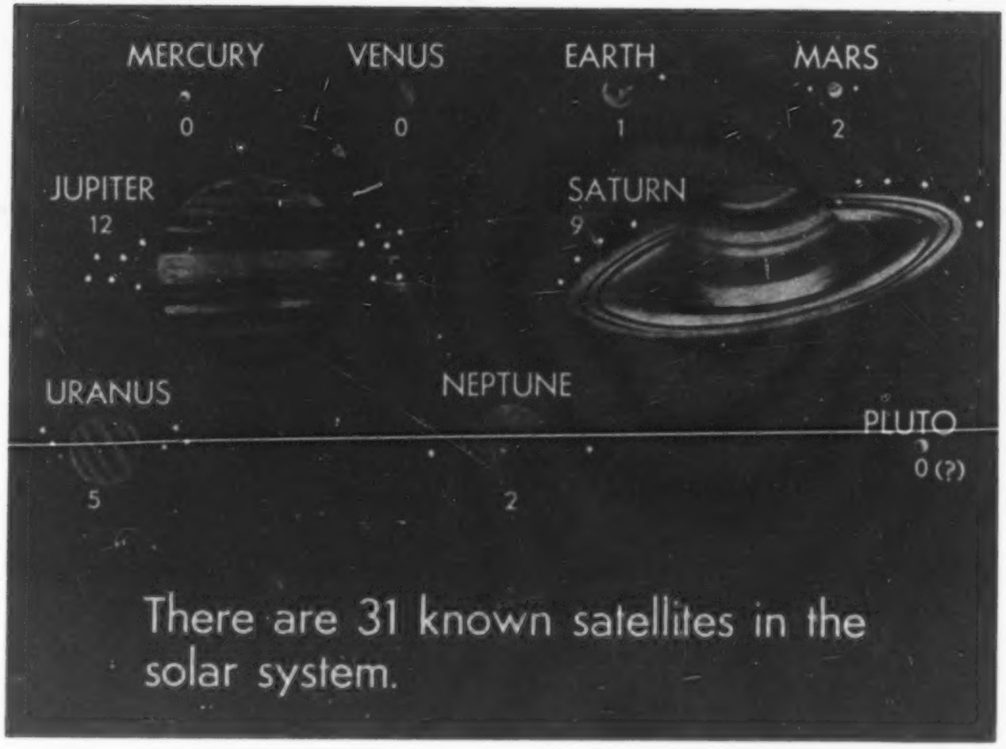
"Saturn, shown here with its rings, has nine."

"Uranus has five."

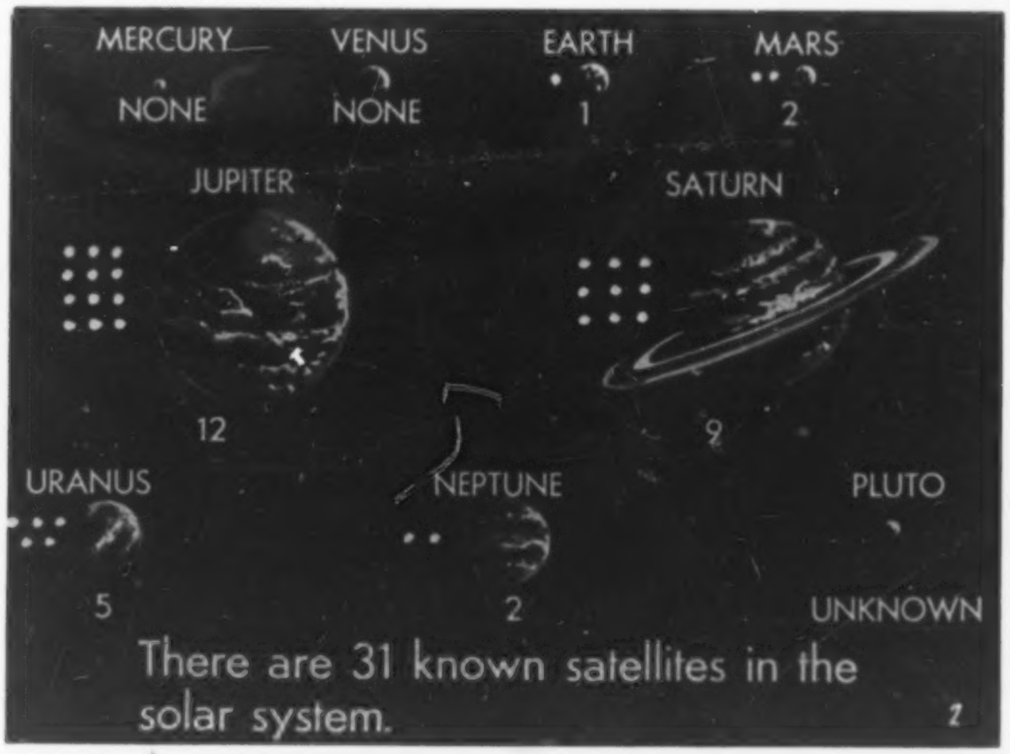
"Neptune has two."

"Pluto is so far away it is unknown whether it has a satellite."

The changes made in the revised version are very small. In place of the zeros for Mercury, Venus, and Pluto, the word "none" or "unknown" was used. Also the moons were placed so that each could be counted easily, to thereby reinforce the figure near each planet. Table 10 shows only slight differences for Items 4-10 which have a bearing upon the pictorial changes. Test results do not, however, bear out the efficacy of this change. Item 9 which tested on the caption stating the total number of satellites in the solar system was, in fact, more frequently answered correctly by those students in grade 5 who saw the original version. (Significant at the .01 level)


MERCURY
0
VENUS
0
EARTH
1
MARS
2
JUPITER
12
SATURN
9
URANUS
5
NEPTUNE
2
PLUTO
0 (?)

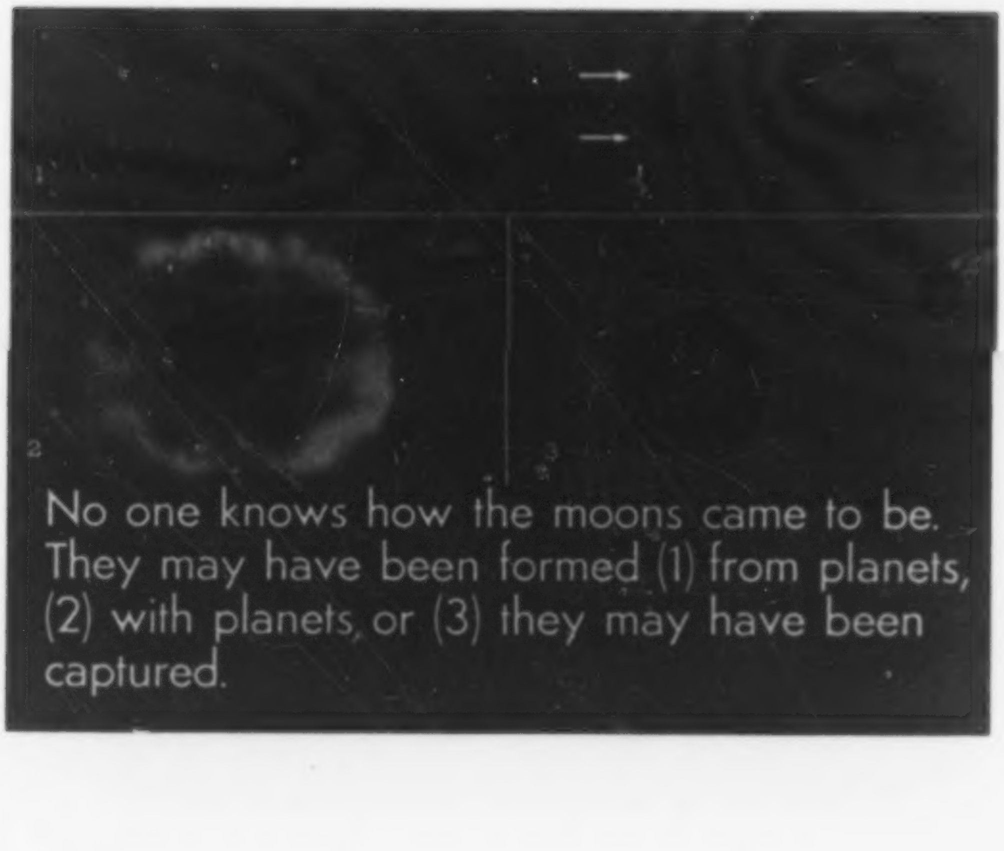
There are 31 known satellites in the solar system.


MERCURY
NONE
VENUS
NONE
EARTH
1
MARS
2
JUPITER
12
SATURN
9
URANUS
5
NEPTUNE
2
PLUTO
UNKNOWN
2

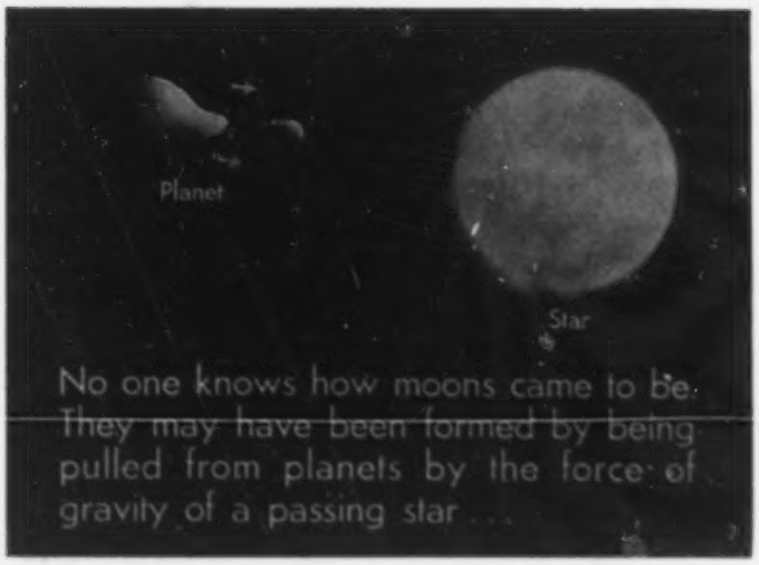
There are 31 known satellites in the solar system.

Frame #3

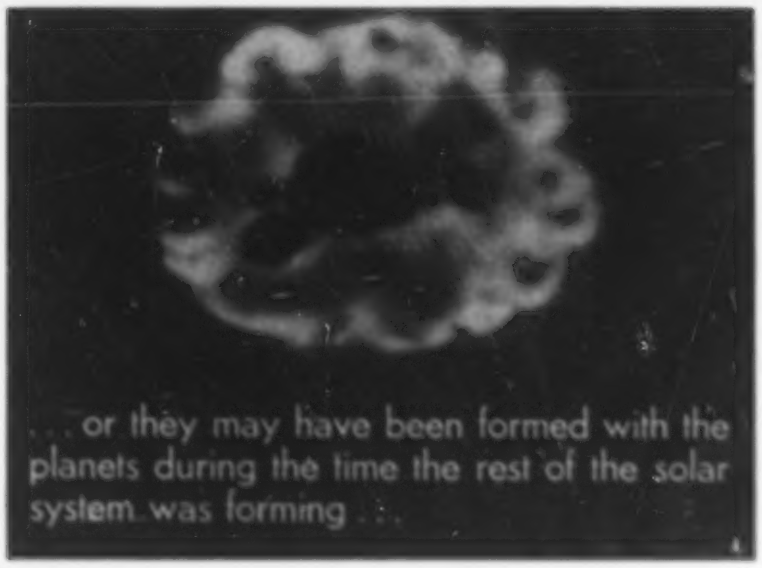
It was hypothesized that by breaking down the information on the origin of the moon into three frames and by changing the "pictures" to reinforce the captions these new frames should bring about greater learning. However, when the frame was divided, new information was added to provide a more logical caption sequence. Perhaps this increase in verbal material counteracted the added clarity provided by dividing the frame; at least, no significant improvement was noted.



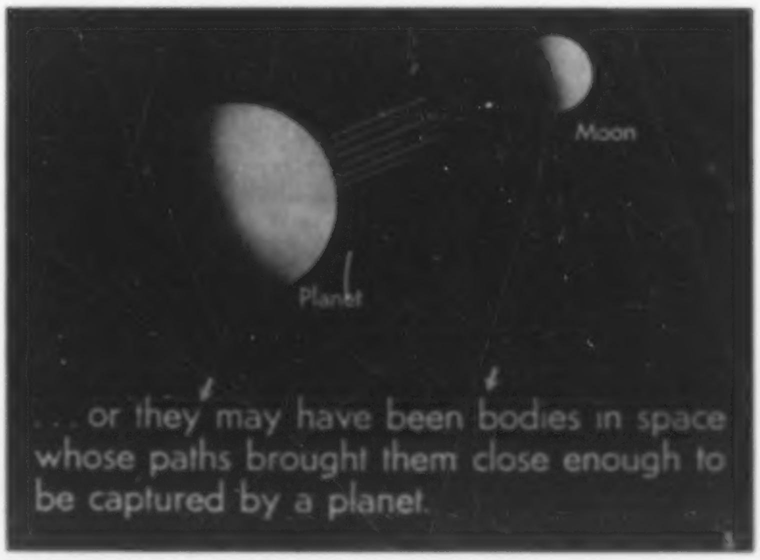
No one knows how the moons came to be. They may have been formed (1) from planets, (2) with planets, or (3) they may have been captured.



No one knows how moons came to be. They may have been formed by being pulled from planets by the force of gravity of a passing star . . .



. . . or they may have been formed with the planets during the time the rest of the solar system was forming . . .



. . . or they may have been bodies in space whose paths brought them close enough to be captured by a planet.

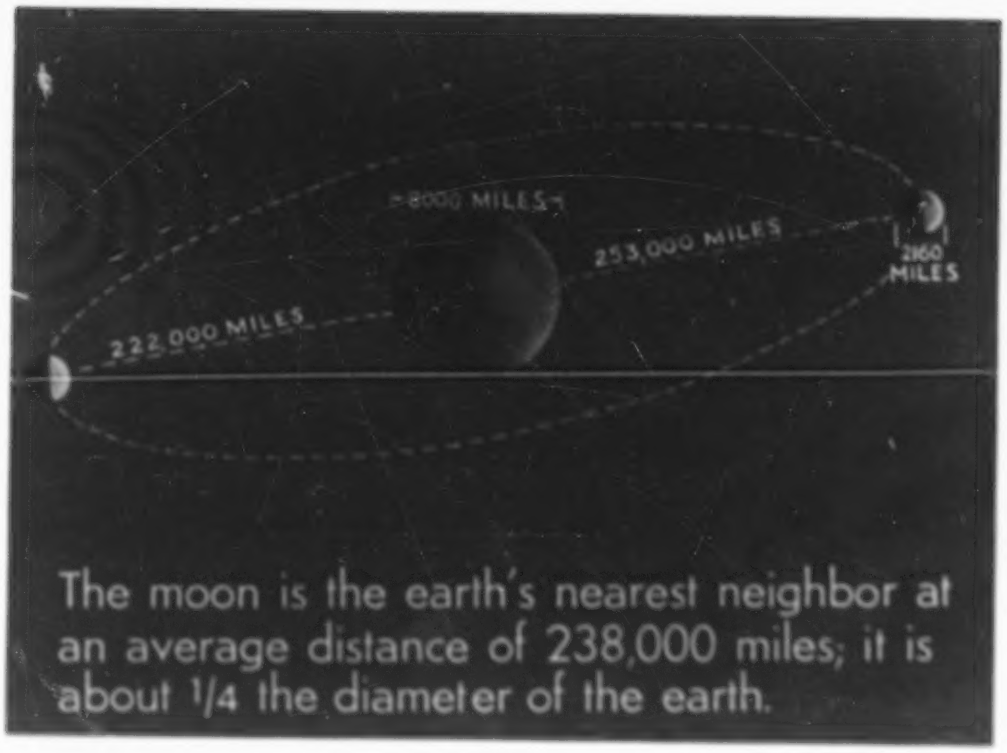
Frame #4

In presenting Frame 4 the caption was read and then the projection pointer was used in making the following comments:

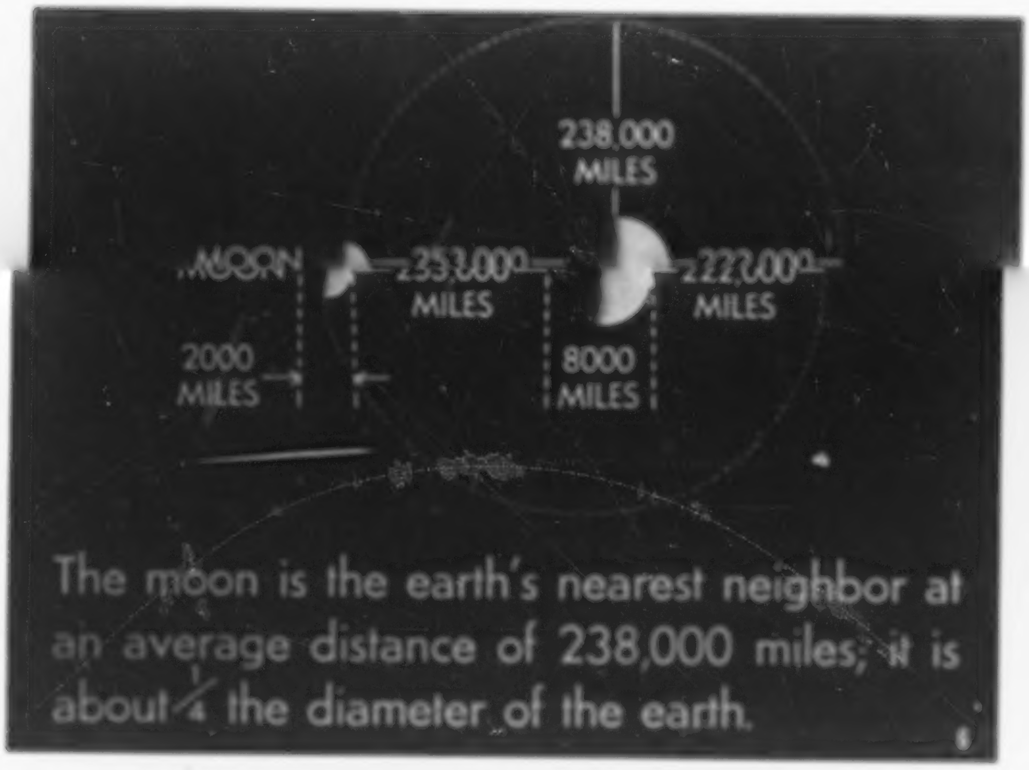
> "Notice that the moon is sometimes as close as
> 222,000 miles from the earth."
> "Sometimes the moon is as far away as
> 253,000 miles from the earth."

In order to make the verbal and pictorial elements reinforce each other in showing that the moon is one-fourth the diameter of the earth in the revision the moon figures were rounded to 2,000 miles, the figures showing the 8,000 mile diameter of the earth were made larger, and both dimensions were put in the same plane in the pictorial element. Thus the 2,000 miles over 8,000 miles would give greater clarity to the 1/4 fraction in the caption. In addition, the average distance that the moon is from earth was inserted in the pictorial element of the revision to reinforce the average distance given in the verbal element.

Although there were no significant differences in all grades tested for items 15 through 20 on this frame it appears that the original version did better in showing the closest point to the earth. On the test item dealing with the diameter comparisons of the moon and earth, only slight differences in the responses were found as can be seen in Table 10 for Item 17. The average distance of the moon from the earth was learned by a greater percentage of subjects in grades five and eleven who saw the revision. It appears that the FSO was somewhat better in teaching the greatest distance that the moon is from the earth. None of these differences was statistically significant, however.


8000 MILES
253,000 MILES
2160 MILES
222,000 MILES

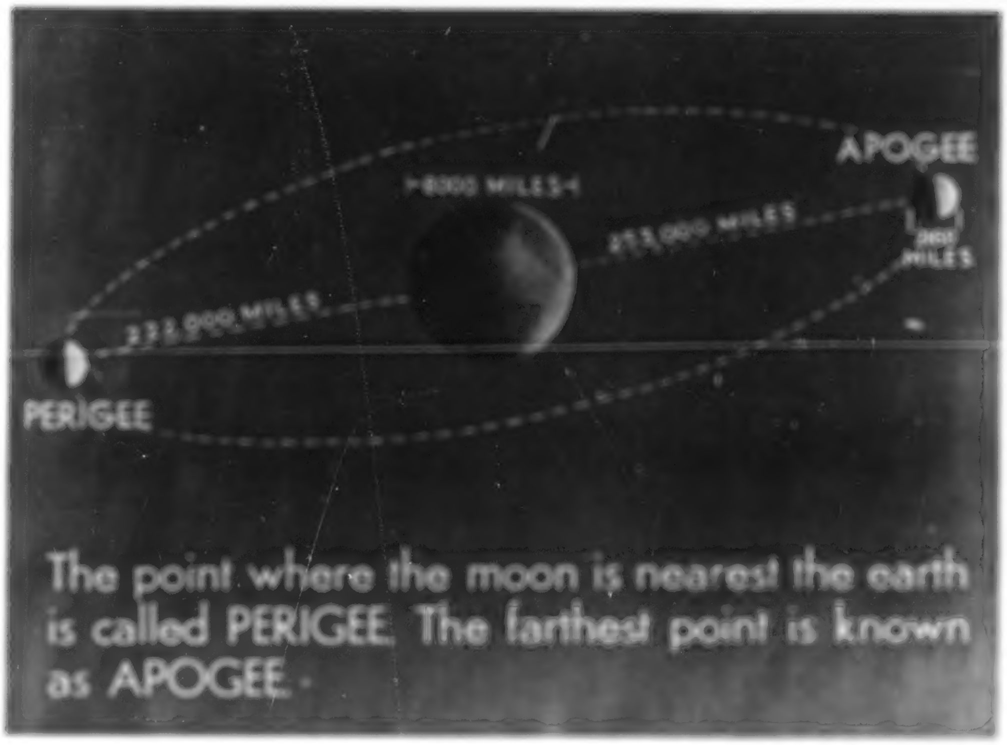
The moon is the earth's nearest neighbor at an average distance of 238,000 miles; it is about 1/4 the diameter of the earth.


238,000 MILES
MOON
253,000 MILES
222,000 MILES
2000 MILES
8000 MILES

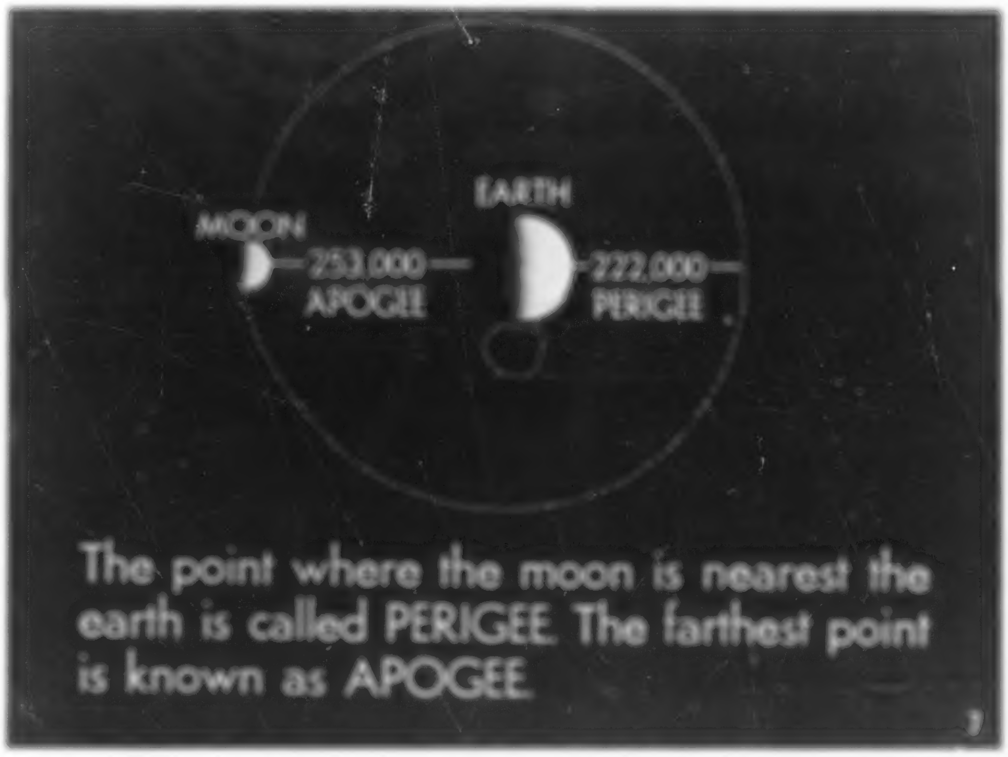
The moon is the earth's nearest neighbor at an average distance of 238,000 miles; it is about 1/4 the diameter of the earth.

Frame #5

In revising Frame 5 the same basic change in the diagram of Frame 4 was retained. There is, however, only one moon in the dotted orbit. It appears that the FSR did somewhat better in teaching the pergee and apogee in grade five but that in grade eight the FSO did better. In grade eleven there was only a slight difference in favor of FSO. None of these differences is statistically significant. It cannot be said, in view of these results, that the changes in the direction of greater iconicity "paid off" in this case.


APOGEE
8000 MILES
253,000 MILES
MILES
222,000 MILES
PERIGEE

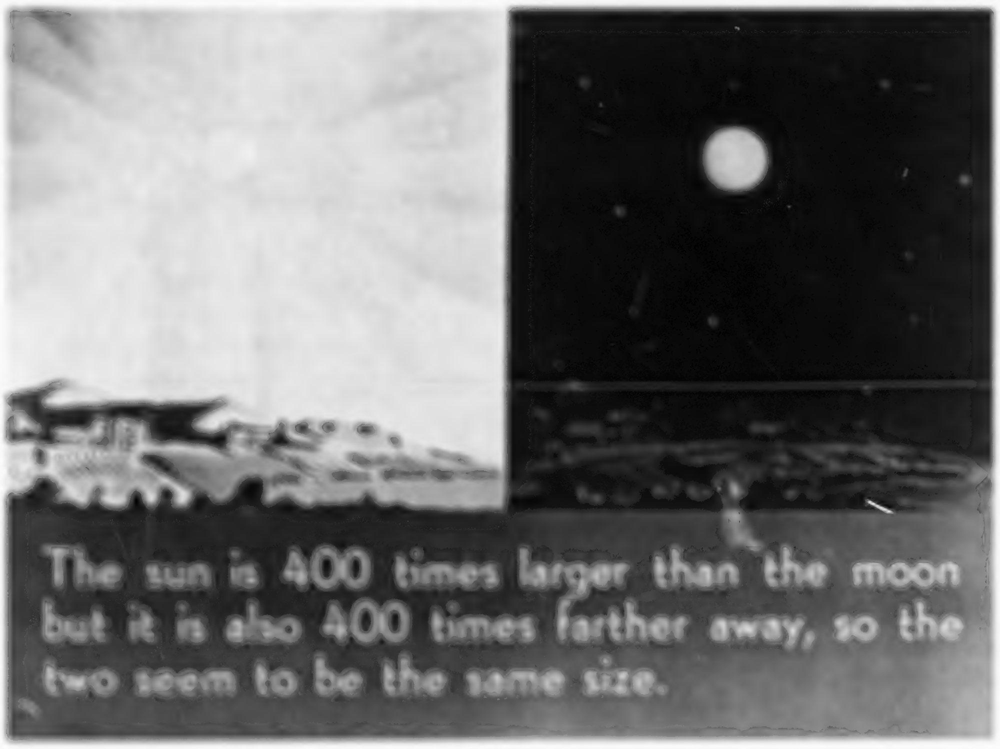
The point where the moon is nearest the earth is called PERIGEE. The farthest point is known as APOGEE.


EARTH
MOON
253,000
APOGEE
222,000
PERIGEE

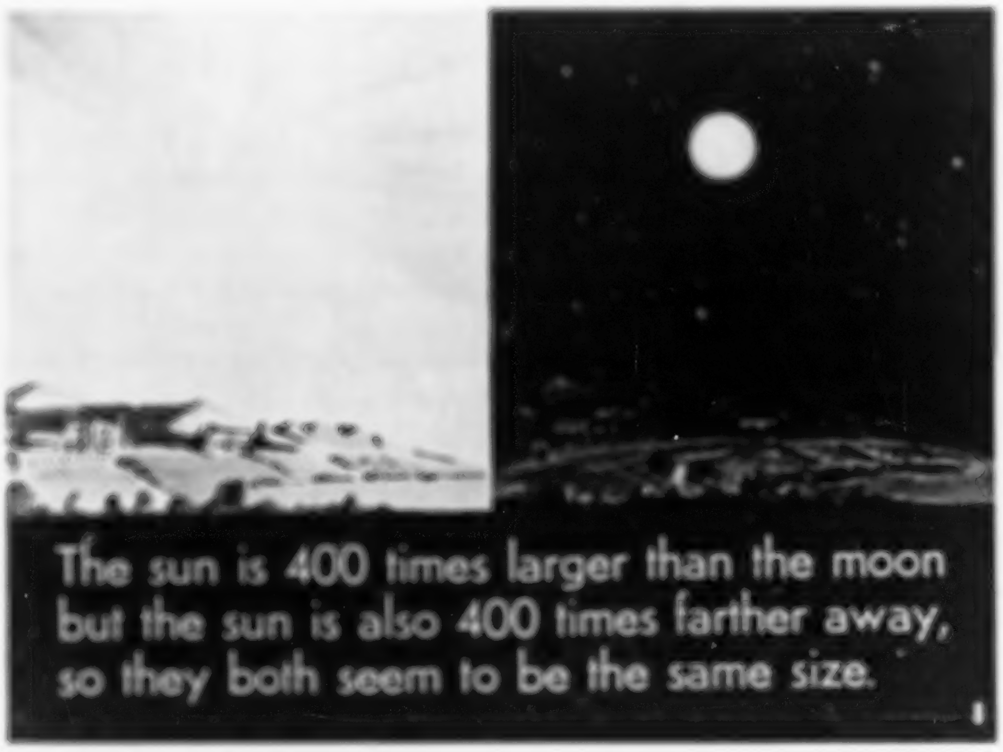
The point where the moon is nearest the earth is called PERIGEE. The farthest point is known as APOGEE.

Frame #6

In revising this frame it was hypothesized that by modifying the rhetorical structure of the caption the pictorial material and the caption would better reinforce each other. An attempt was also made to cause the disc of the sun appear more sharply defined so that it would look equal in size to the disc of the moon. However, emulsion difficulties prevented the achievement of this revision. There were no significant differences between the versions in proportions passing the item based on this frame.



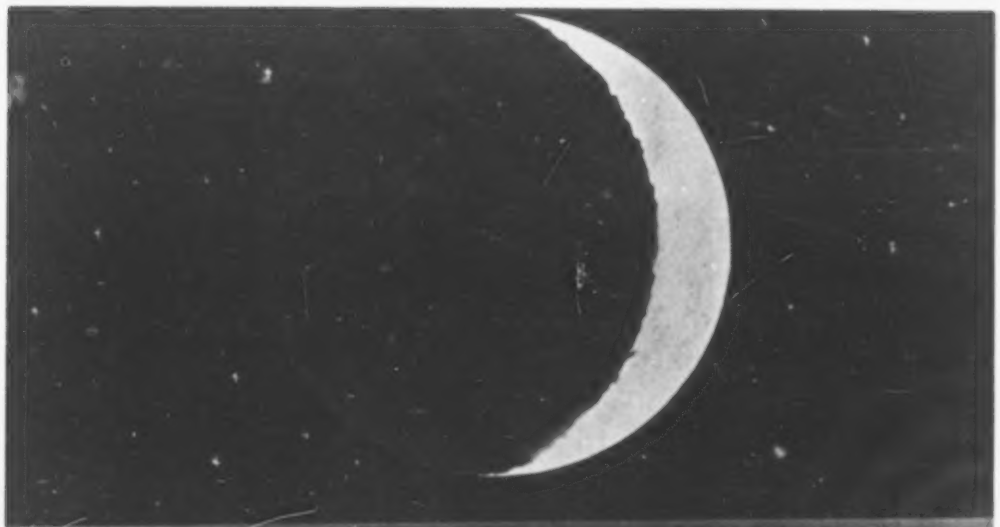
The sun is 400 times larger than the moon but it is also 400 times farther away, so the two seem to be the same size.



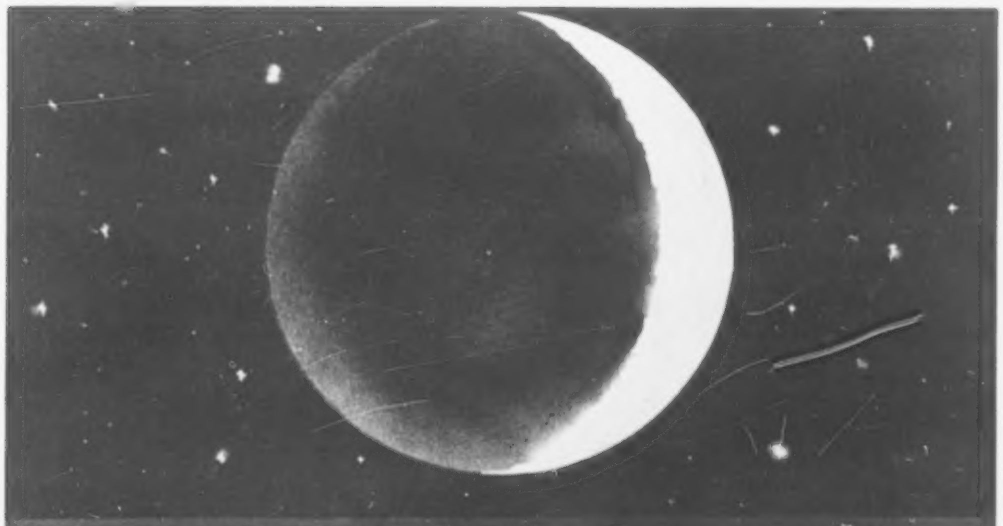
The sun is 400 times larger than the moon but the sun is also 400 times farther away, so they both seem to be the same size.

Frame #7

The only changes made in this frame were to remove the light spots in the dark portion of the moon on the original version. Results of Items 24 and 25 show this "improvement" made little difference in the learning. Of course, the proportion passing these items were originally nearly 100; so little added increment of learning remained.



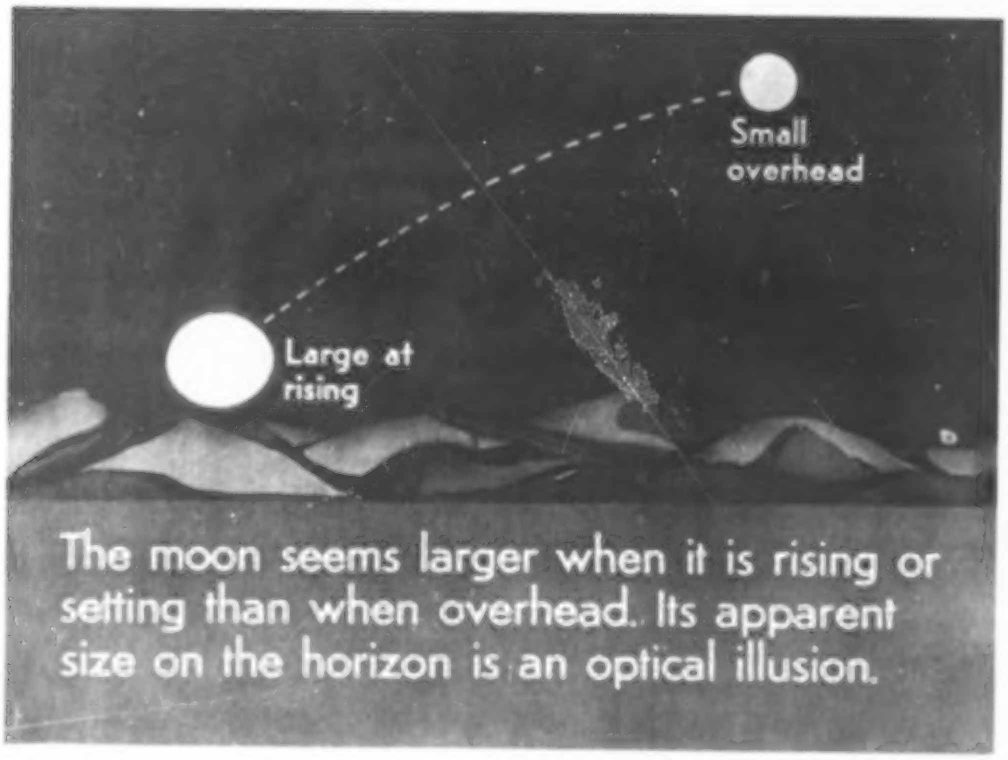
The moon shines mainly by reflected sunlight but we sometimes see part of it by reflected earthlight.



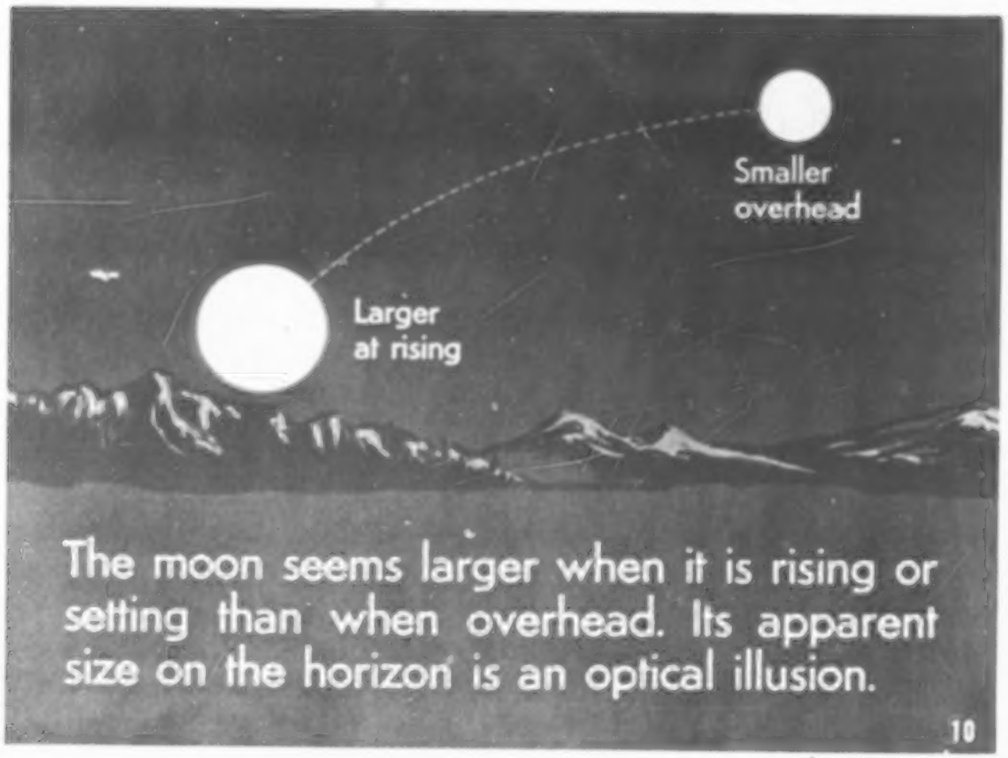
The moon shines mainly by reflected sunlight but we sometimes see part of it by reflected earthlight.

Frame #8

In revising this frame it was intended to improve the pictorial by making the moon appear much larger at rising and smaller overhead. For some reason, however, the original version did much better in grade five in teaching the term optical illusion (at the .05 level). However, the revised filmstrip taught significantly better than the original the concept that the moon appears to be larger when rising and smaller when overhead. The revised version showed an improvement for grade eleven also in teaching the same concept, although the difference was not a significant one.


Small
overhead
Large at
rising

The moon seems larger when it is rising or setting than when overhead. Its apparent size on the horizon is an optical illusion.


Smaller
overhead
Larger
at rising
10

The moon seems larger when it is rising or setting than when overhead. Its apparent size on the horizon is an optical illusion.

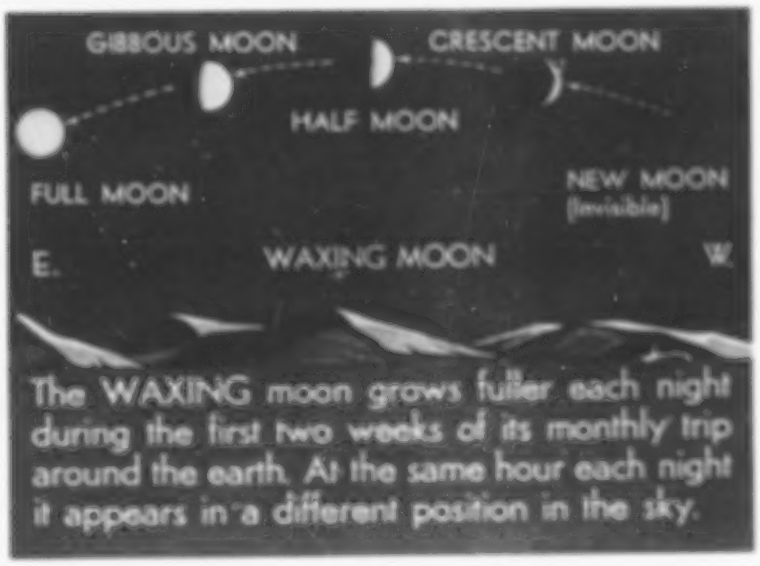
Frame #9

Frame 9 was divided into two frames on the revision. Both frames were shown before testing. In the FSR the first frame (Fig. 9-A) removed any symbol for the new moon and instead an arrow was inserted showing the position where the new moon would be in the sky. The iconicity of the graphic material was improved by deleting the black "invisible" parts of the moon. In the revision in the second frame (Fig. 9-B) the time 8:00 p.m. was used for the different phases in relationship to the position where they would appear in the sky on different dates. The verbal material reinforced this idea in that the time element was mentioned. Item 30 shows the revision to have produced a significant increase in learning in all three grades tested. The differences in proportions passing Item 31 supports the hypothesis that giving greater realism to the moon symbols is capable of producing significant improvement in learning as is revealed by the results in grade eight.

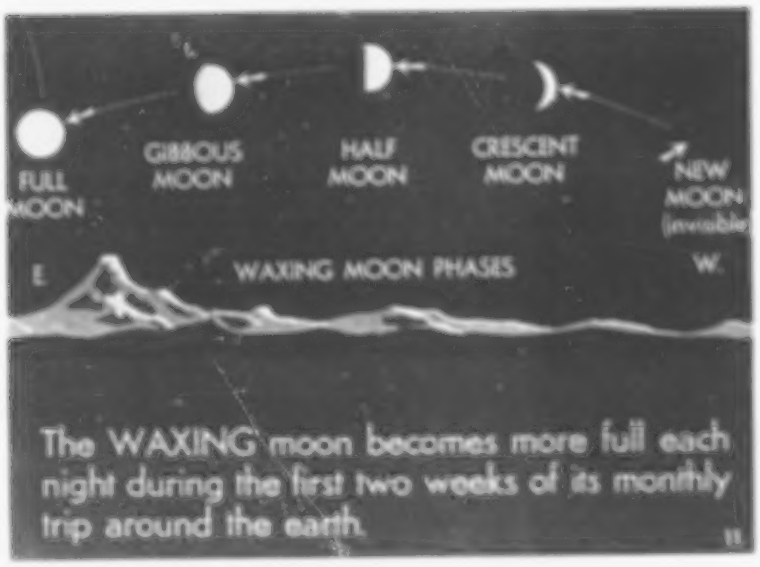
It appears that the addition of time and dates contributed to improvement in learning the concept that the moon would be found in a different position in the sky on different nights at the same hour. Item 30 is significant in favor of FSR all grades tested.

Only in grade eight was Item 31 significant in favor of FSR. It seems to support the hypothesis that some realism can improve learning in diagrams.

There is one question that might be raised. Is the significant improvement in learning the result of increased viewing time? In this study students viewing the revision would have been given double time because of two frames.

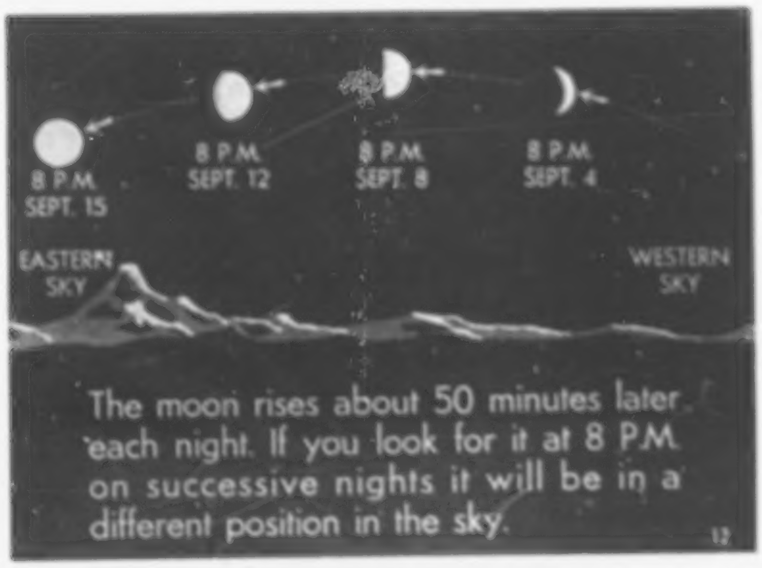

GIBBOUS MOON
CRESCENT MOON
HALF MOON
FULL MOON
NEW MOON (invisible)
E.
WAXING MOON
W.

The WAXING moon grows fuller each night during the first two weeks of its monthly trip around the earth. At the same hour each night it appears in a different position in the sky.


FULL MOON
GIBBOUS MOON
HALF MOON
CRESCENT MOON
NEW MOON (invisible)
E.
WAXING MOON PHASES
W.

The WAXING moon becomes more full each night during the first two weeks of its monthly trip around the earth.

11


8 P.M. SEPT. 15
8 P.M. SEPT. 12
8 P.M. SEPT. 8
8 P.M. SEPT. 4
EASTERN SKY
WESTERN SKY

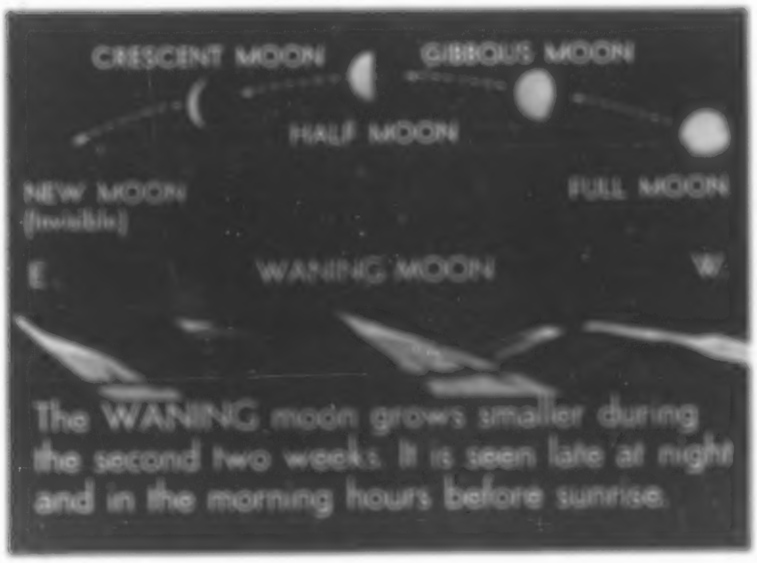
The moon rises about 50 minutes later each night. If you look for it at 8 P.M. on successive nights it will be in a different position in the sky.

12

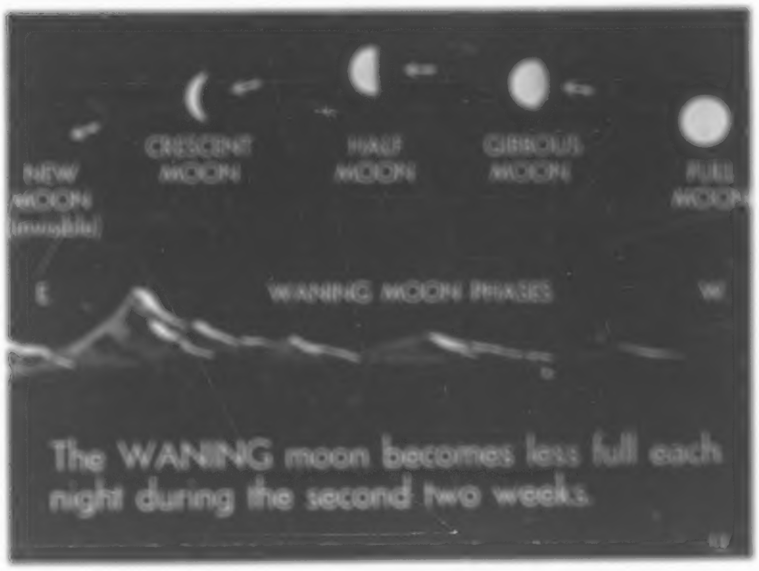
Frame #10

The FSR for Frame 10 was again divided into two frames, with the same pictorial changes as for Frame 9. No additional information was added to the verbal content. The caption, however, was shortened and made more accurate. Item 32 dealing with the period time during which the moon wanes shows virtually no difference between FSO and FSR. Item 33 testing the meaning of "waning", shows an improvement in learning for all three grades in favor of FSR, with a significant improvement at .01 for grade eleven.

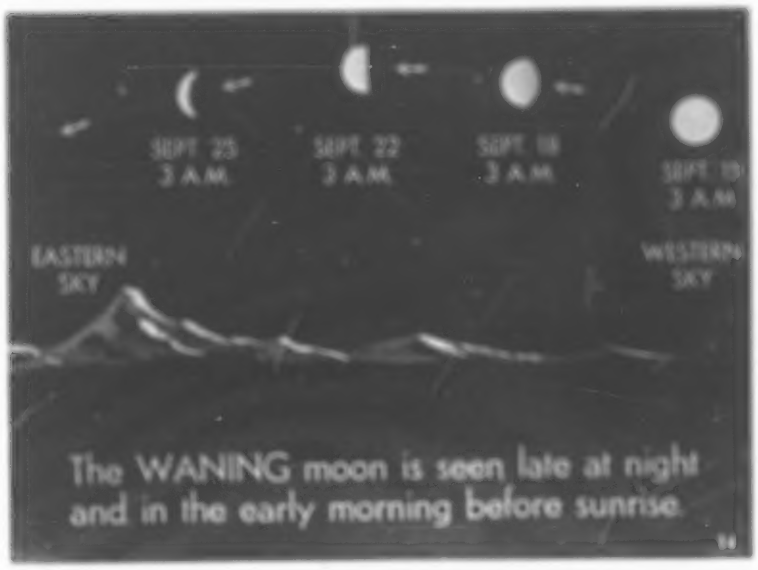
Item 34 also shows improvement in favor of FSR in grade eight and eleven, with a .01 significance for grade eight.


CRESCENT MOON
GIBBOUS MOON
HALF MOON
NEW MOON
(invisible)
FULL MOON
E
WANING MOON
W

The WANING moon grows smaller during the second two weeks. It is seen late at night and in the morning hours before sunrise.


NEW MOON (invisible)
CRESCENT MOON
HALF MOON
GIBBOUS MOON
FULL MOON
E
WANING MOON PHASES
W

The WANING moon becomes less full each night during the second two weeks.

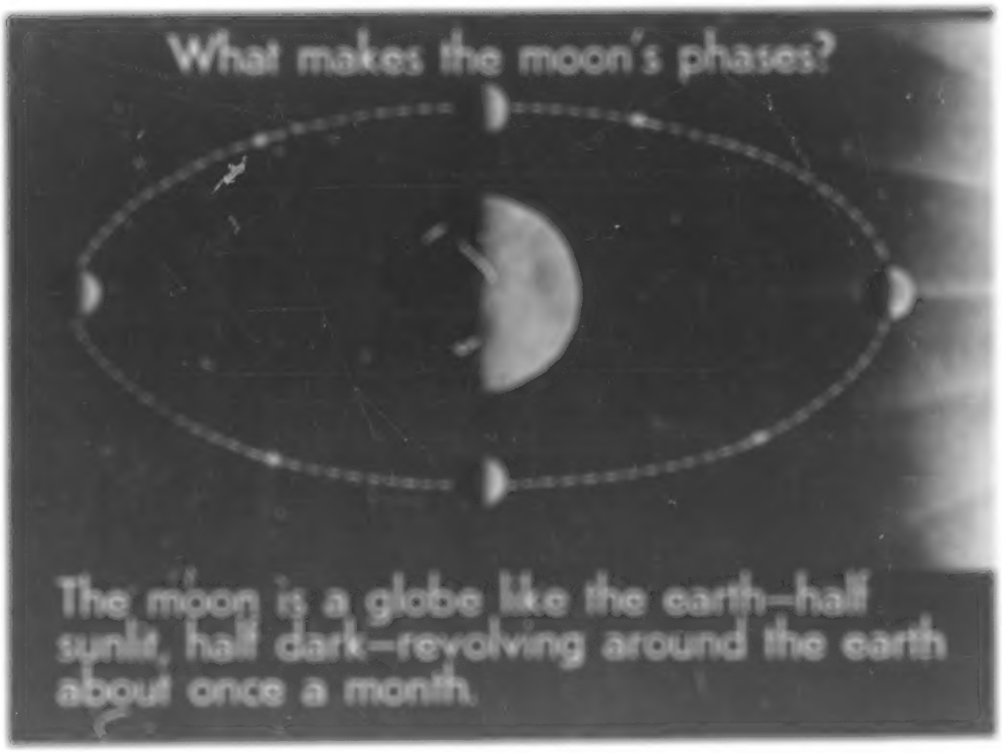

SEPT. 25
3 A.M.
SEPT. 22
3 A.M.
SEPT. 18
3 A.M.
SEPT. 15
3 A.M.
EASTERN SKY
WESTERN SKY

The WANING moon is seen late at night and in the early morning before sunrise.

Frame #11

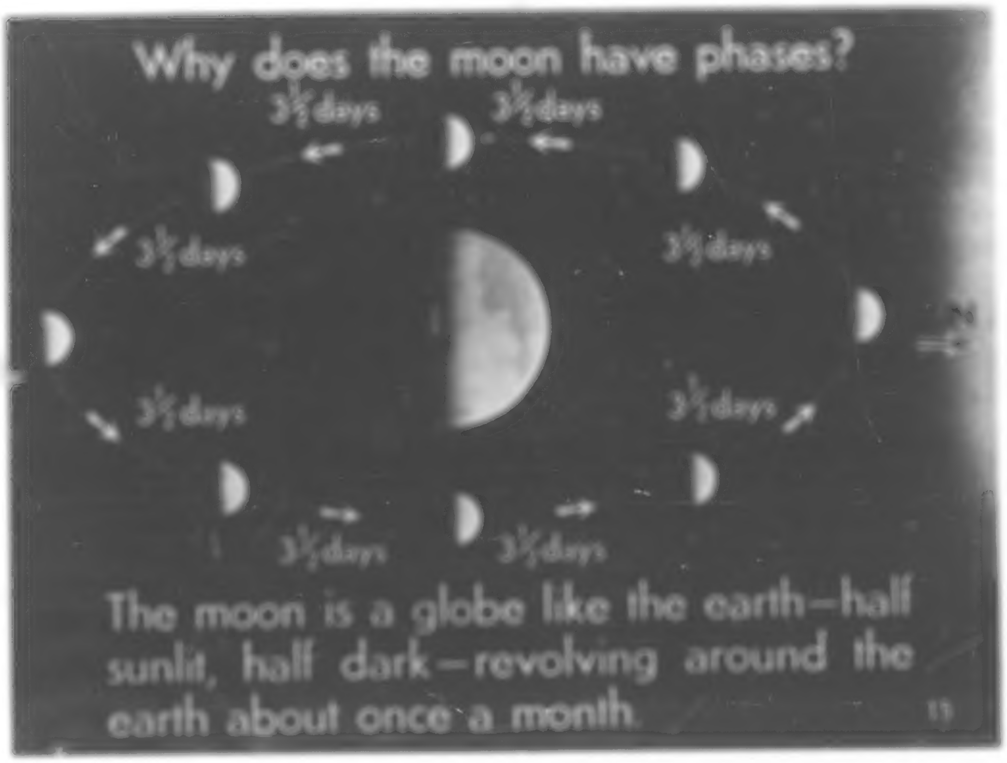
In considering Frame 11 it was felt that by adding a moon to each phase position, clarity would be achieved for the concept dealing with why the moon has phases. The arrows were also enlarged. The verbal material remained the same. Items 35 and 36 showed that these were no significant improvements in learning. Evidently the graphic addition to the pictorial matter in FSR did not prove any greater reinforcement of the caption than did the FSO.

Item 61 shows that pupils learned the concept of the division of the moon's changes into four phases even though the testing item was placed at the end of the filmstrip sequence. The FSO taught this concept only indirectly. Adding the caption "7 1/2 DAYS" to Frame 11, resulted in greater learning in all grades with a significant improvement in grade five and in the senior high group.



What makes the moon's phases?

The moon is a globe like the earth—half sunlit, half dark—revolving around the earth about once a month.



Why does the moon have phases?

3½ days
3½ days
3½ days
3½ days
3½ days
3½ days
3½ days
3½ days
11

The moon is a globe like the earth—half sunlit, half dark—revolving around the earth about once a month.

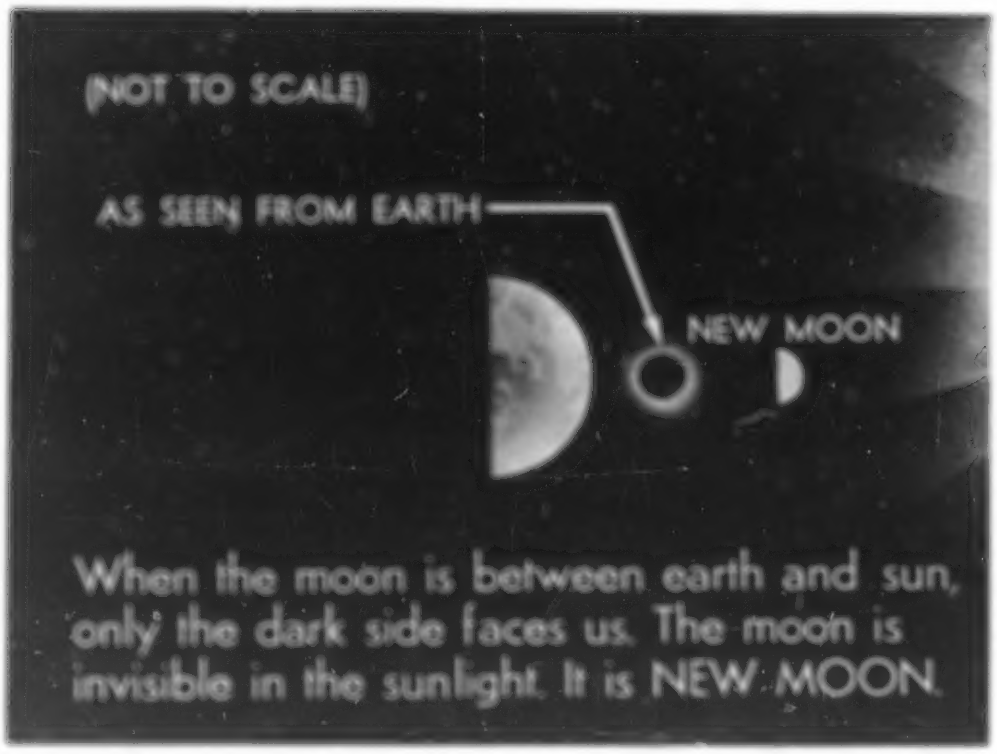
Frame #12

Frame 12 begins a sequence on the position of the moon relative to the sun and earth for each phase during a month. The date of appearance of each stage in the revolution was added to each of the waxing and waning moon frames. In FSR an attempt also was made to make the pictorial content consistent with the verbal content of each frame. For example, FSO Frame 12 states the moon is invisible in the sunlight but uses a black disk with a halo to show how it is seen from the earth. (It is true this may occur during a solar eclipse).
In FSO two moons are diagrammed for each phase. This seemed to cause confusion in the validation testing phase.

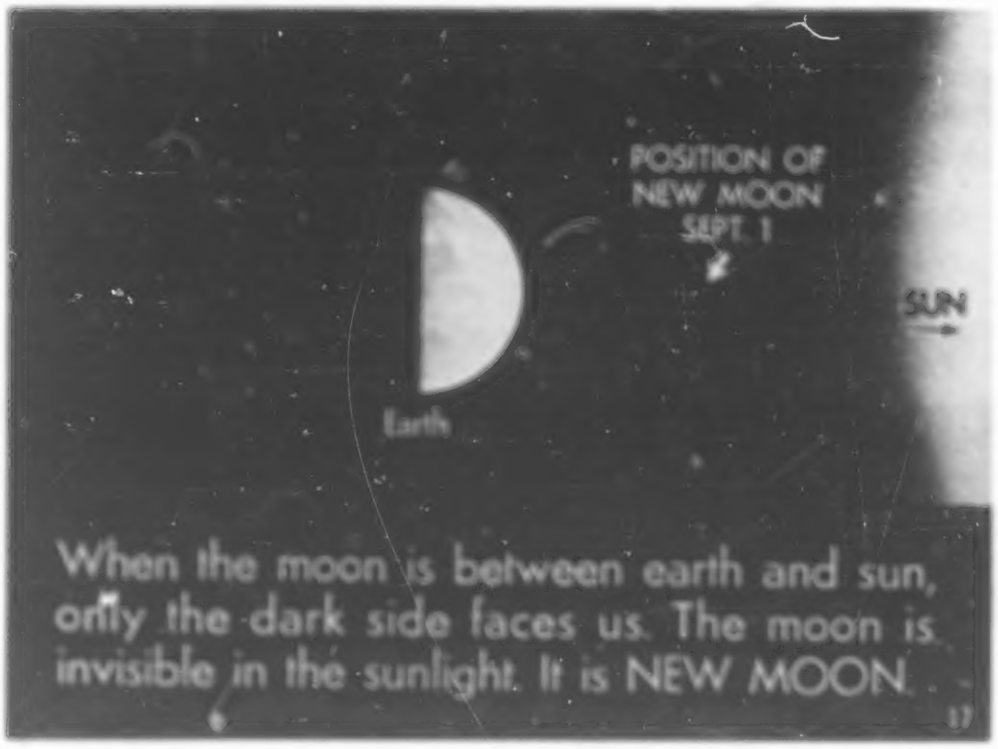
Item 37 produced a slight difference in favor of FSO in testing for the correct position of the moon in its new moon phase. It is believed, however, that students may have confused the larger moon diagram in FSO with the sun to account for this.

Item 38 which tested how the moon appears as seen from earth - did not support the above pictorial change significantly for FSR.

Item 39 tested verbally the same concept that Item 37 had tested pictorially. The difference favors the FSO, but is significantly only for grade eight.


(NOT TO SCALE)
AS SEEN FROM EARTH
NEW MOON

When the moon is between earth and sun, only the dark side faces us. The moon is invisible in the sunlight. It is NEW MOON.


POSITION OF
NEW MOON
SEPT. 1
SUN
Earth
17

When the moon is between earth and sun, only the dark side faces us. The moon is invisible in the sunlight. It is NEW MOON.

Frame #13

The same basic ideas that went into the revision of Frame 12 appear in Frame 13; in FSR the sun bears a label, the extra moon with the arrow of "visible from earth" is omitted, the crescent moon is made more realistic, and the earth is labelled.

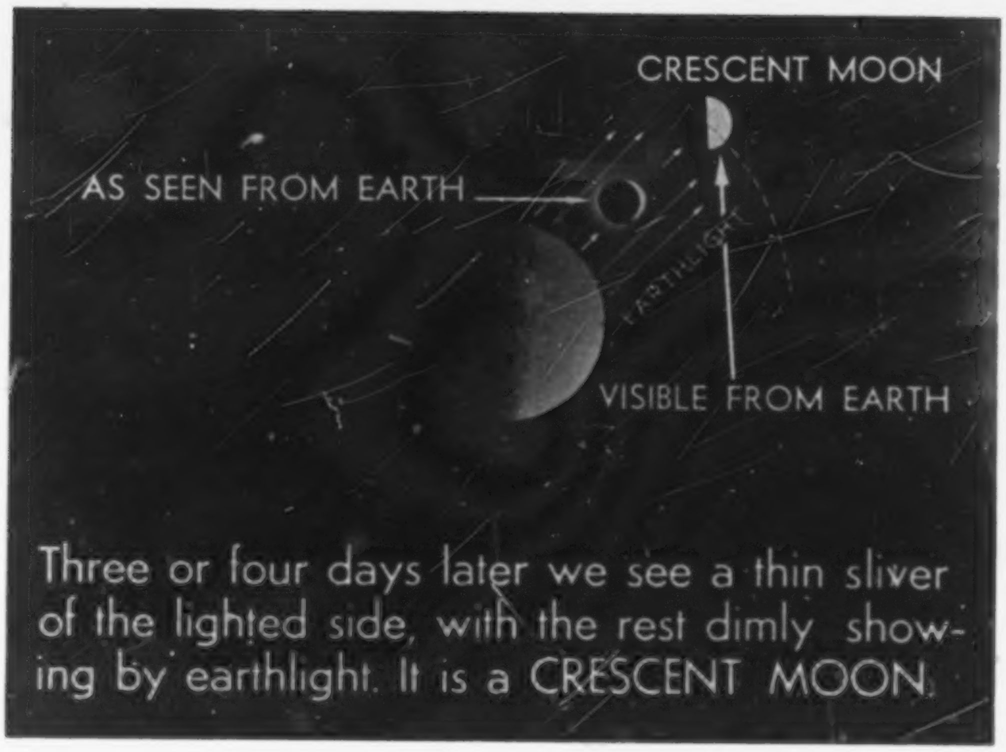
It was hypothesized that adding a point of reference prior to the introduction of each phase of the moon would be conducive to learning. Therefore, FSR verbal material was changed to "A little more than three days after new moon". Item 40, however, shows only slight differences and they are in the negative direction for learning phase relationships.

Item 41 supports the hypothesis that the important facts presented in the verbal material should be well reinforced by the pictorial element. Accordingly, the confusing captions "visible from earth" and "seen from earth", with the necessitated "double image" were deleted. The FSR produced significantly greater learning in grade eight in selecting a diagram of the crescent moon.

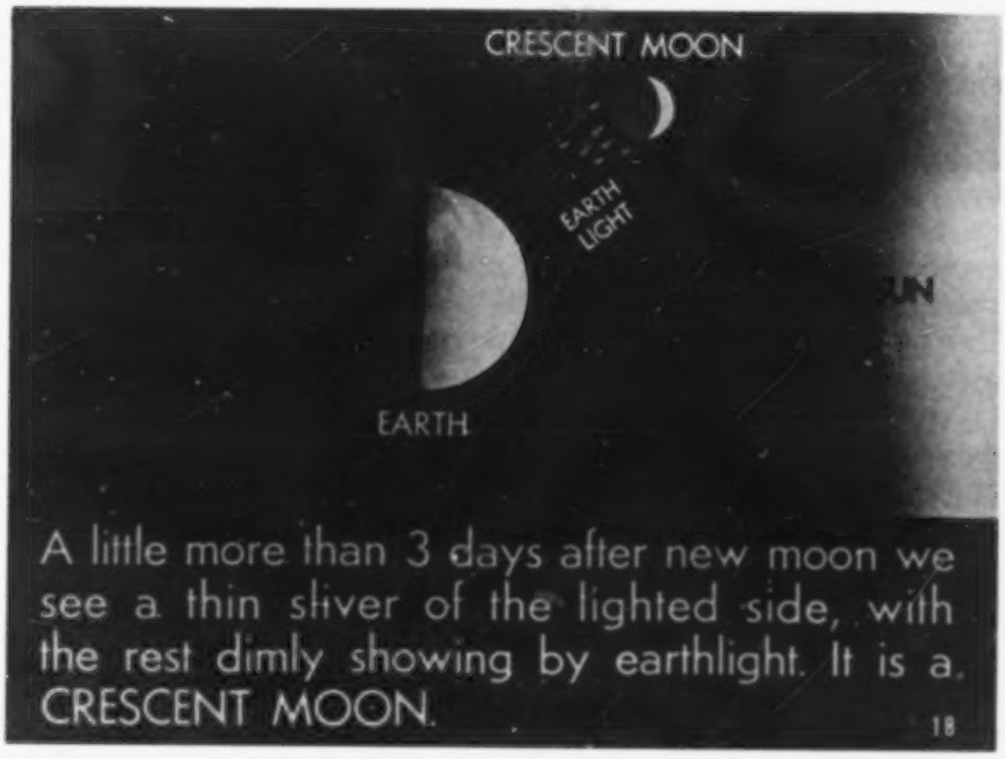
Item 42 supports the value of giving as a point of reference a preceding moon phase in teaching the time from new moon to crescent moon. The FSR shows improvement in all grades tested, with a significant improvement in grade eight.

The responses to Item 43 support the hypothesis of the effectiveness labels and of making a diagram simple to achieve learning. There was superiority in all three grades for FSR.

2


CRESCENT MOON
AS SEEN FROM EARTH
EARTHLIGHT
VISIBLE FROM EARTH

Three or four days later we see a thin sliver of the lighted side, with the rest dimly showing by earthlight. It is a CRESCENT MOON.

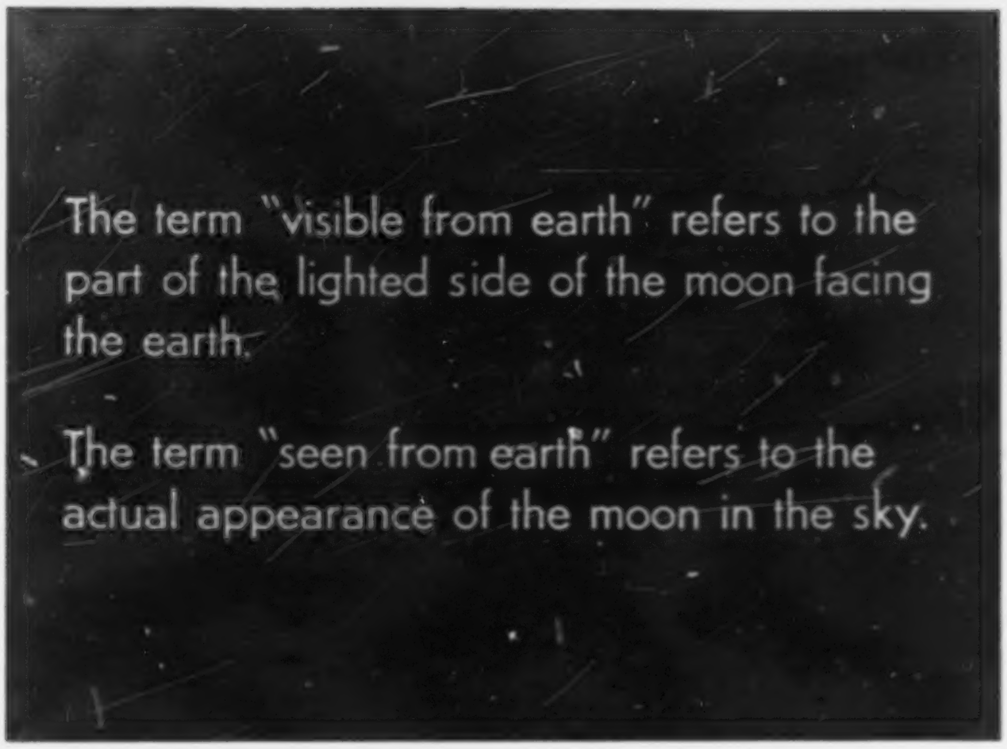

CRESCENT MOON
EARTH LIGHT
UN
EARTH

A little more than 3 days after new moon we see a thin sliver of the lighted side, with the rest dimly showing by earthlight. It is a CRESCENT MOON.

18

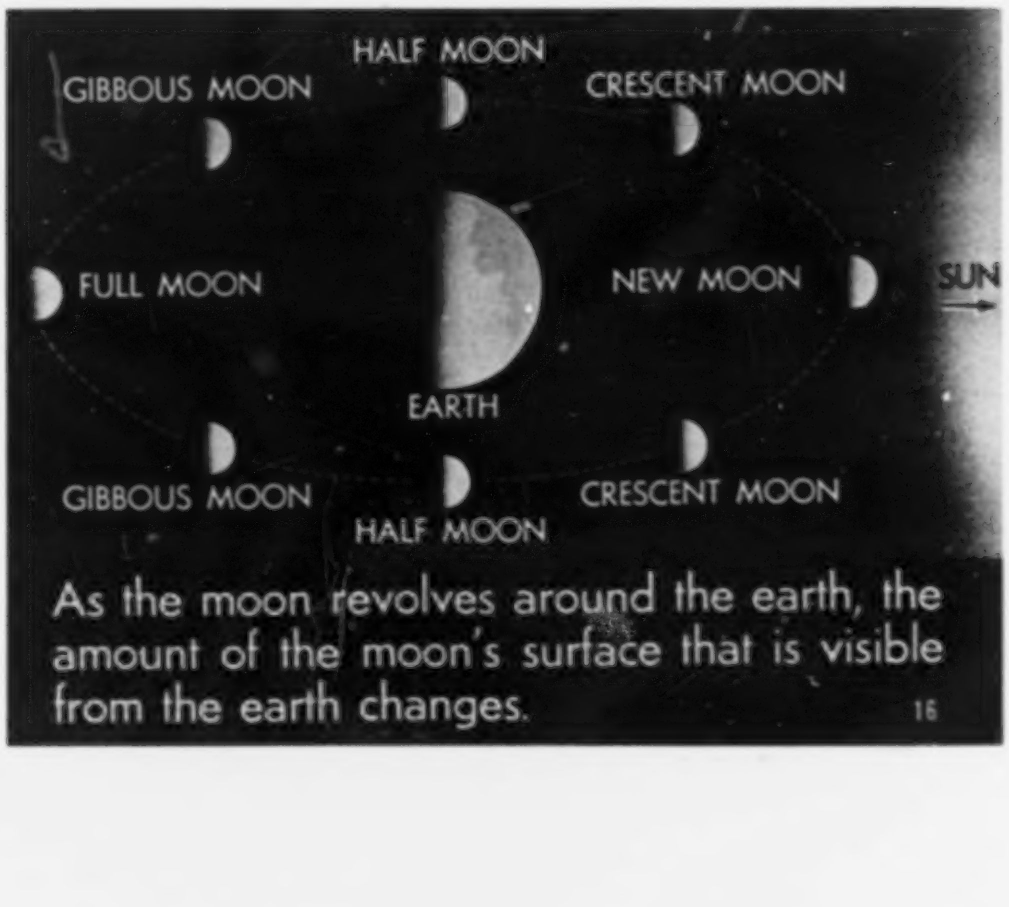
Frame #14

There was no test item given for this frame nor for its corresponding explanatory frame of FSR. There is a difference between the filmstrip versions that should be kept in mind in this connection, however. In the revised version, Frame 16 was used to begin the sequence on the phases of the moon. In the original, Frame 14 was inserted between the frames showing the crescent moon that first appears after the new moon and the frame showing the first quarter. It would be extremely difficult to assess any definite effects on learning that might have resulted. Both frames were presented, however, but no test items followed.



The term "visible from earth" refers to the part of the lighted side of the moon facing the earth.

The term "seen from earth" refers to the actual appearance of the moon in the sky.


HALF MOON
GIBBOUS MOON
CRESCENT MOON
FULL MOON
NEW MOON
SUN
EARTH
GIBBOUS MOON
CRESCENT MOON
HALF MOON

As the moon revolves around the earth, the amount of the moon's surface that is visible from the earth changes. 16

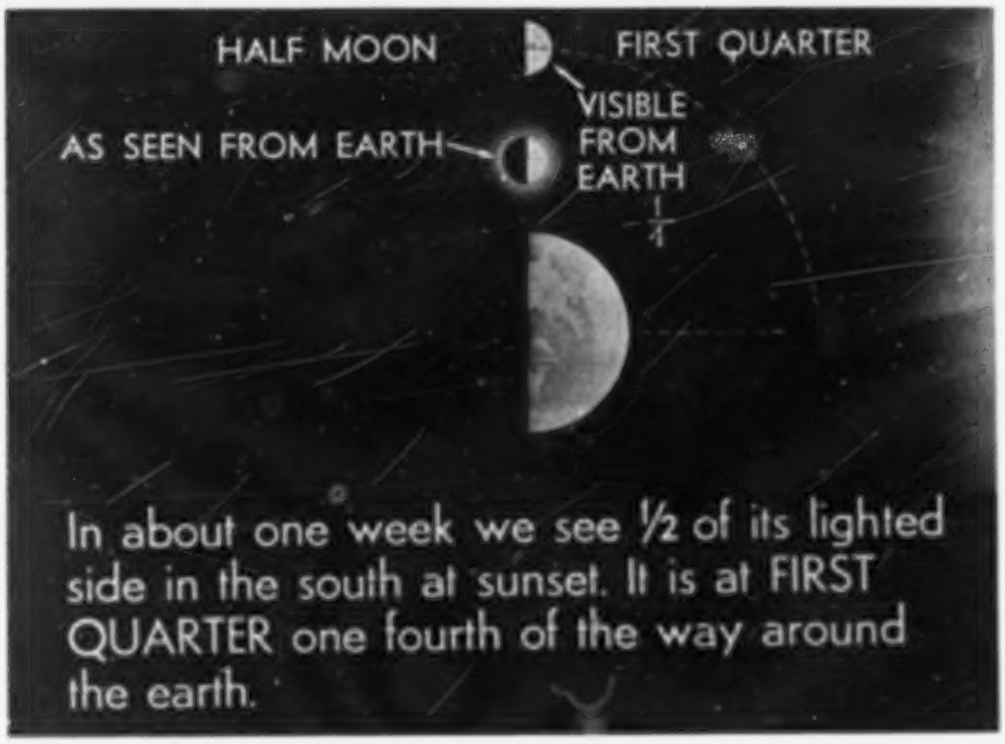
Frame #15

Item 44 again supports the hypothesis that verbal material added to the pictorial element can improve learning when it is consistent with the pictorial element. The FSR uses three methods to show that it takes a week for the moon to reach first quarter from new moon - the caption, dates of Sept. 1 to Sept. 7, and the words "one week" on the dotted orbit line. Although this seems to make no difference for senior high groups, improvement is shown in the FSR in grade five and significantly shown in grade eight.

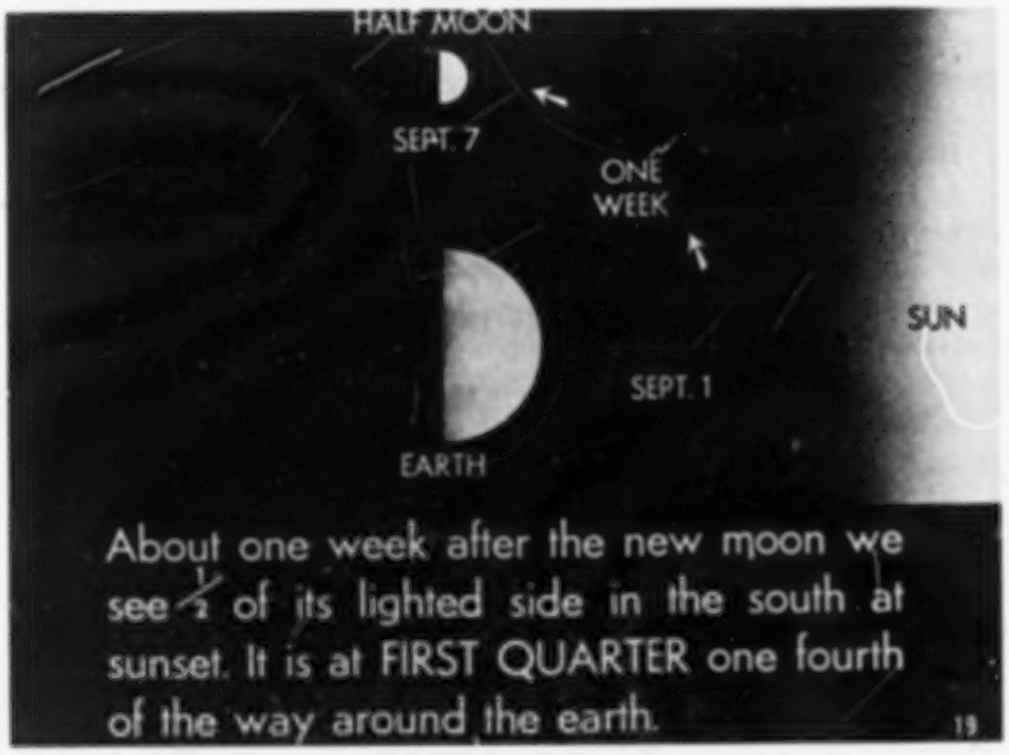
When putting the one week concept in terms of dates in Item 45, the FSR resulted in improvement for all grades tested. The differences were significant for grade eight and the senior high groups.

Item 46 shows improvement resulting from the FSR for all grades in being able to identify the appearance of the moon at first quarter, although the differences are not significant. In a future revision the words FIRST QUARTER might be added to the pictorial element - in addition to the label HALF MOON.

Item 47 also shows an improvement in learning for FSR in all grades tested, with a significant improvement in grade eight. Apparently the single moon and the label HALF MOON supplemented the verbal material to bring about improved learning.


HALF MOON
FIRST QUARTER
AS SEEN FROM EARTH
VISIBLE FROM EARTH
1/4

In about one week we see ½ of its lighted side in the south at sunset. It is at FIRST QUARTER one fourth of the way around the earth.


HALF MOON
SEPT. 7
ONE WEEK
SUN
SEPT. 1
EARTH
19

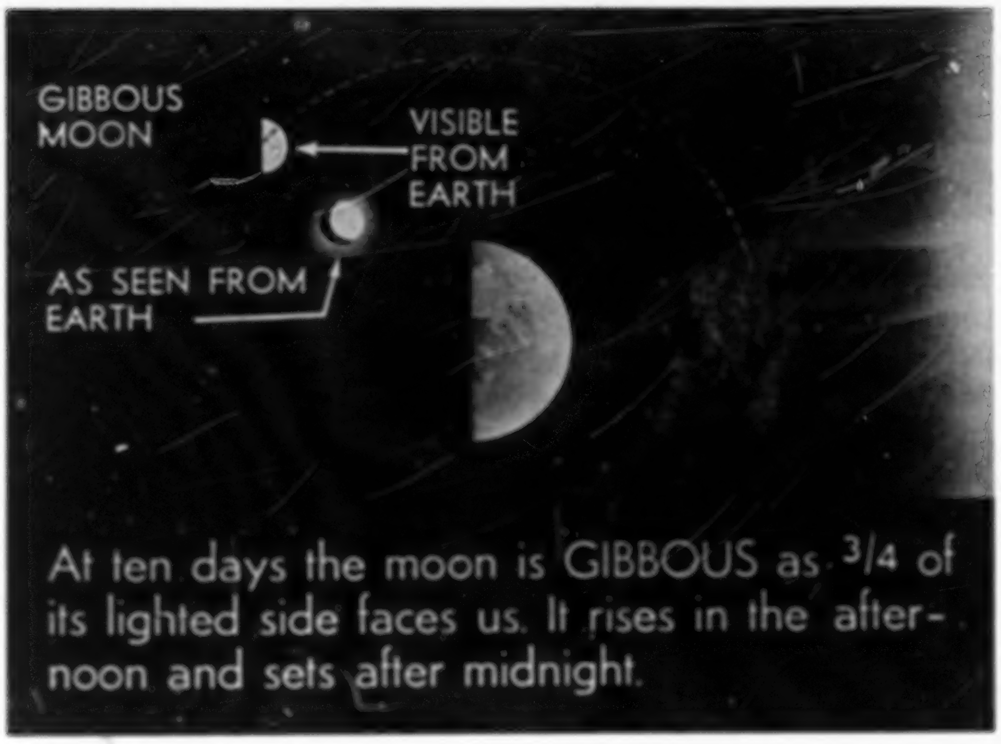
About one week after the new moon we see ½ of its lighted side in the south at sunset. It is at FIRST QUARTER one fourth of the way around the earth.

Frame #16

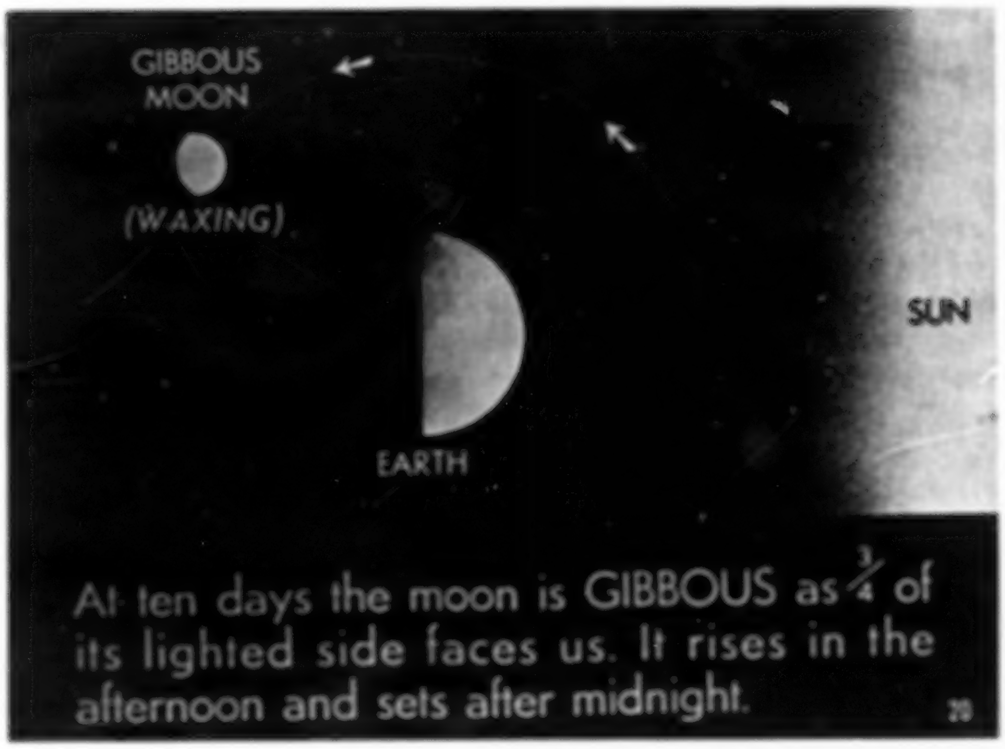
It was difficult to use the pictorial element to reinforce the verbal in teaching that three-fourths of the moon's lighted side is seen from earth when it is gibbous. It is believed the FSR comes closer to achieving this than FSO because of the added moon diagram "seen from earth" in FSO. This second moon may distract since it is the larger moon and it is shown as half light and half dark.

Responses to Item 48 which tested this information favor FSR in all grades, but in no grade is the difference statistically significant.

The FSR showed improved learning of the identification of the gibbous moon. All Item 49 differences favor the FSR with a significant improvement in grade five and eight at the .01 level.


GIBBOUS MOON
VISIBLE FROM EARTH
AS SEEN FROM EARTH

At ten days the moon is GIBBOUS as 3/4 of its lighted side faces us. It rises in the afternoon and sets after midnight.

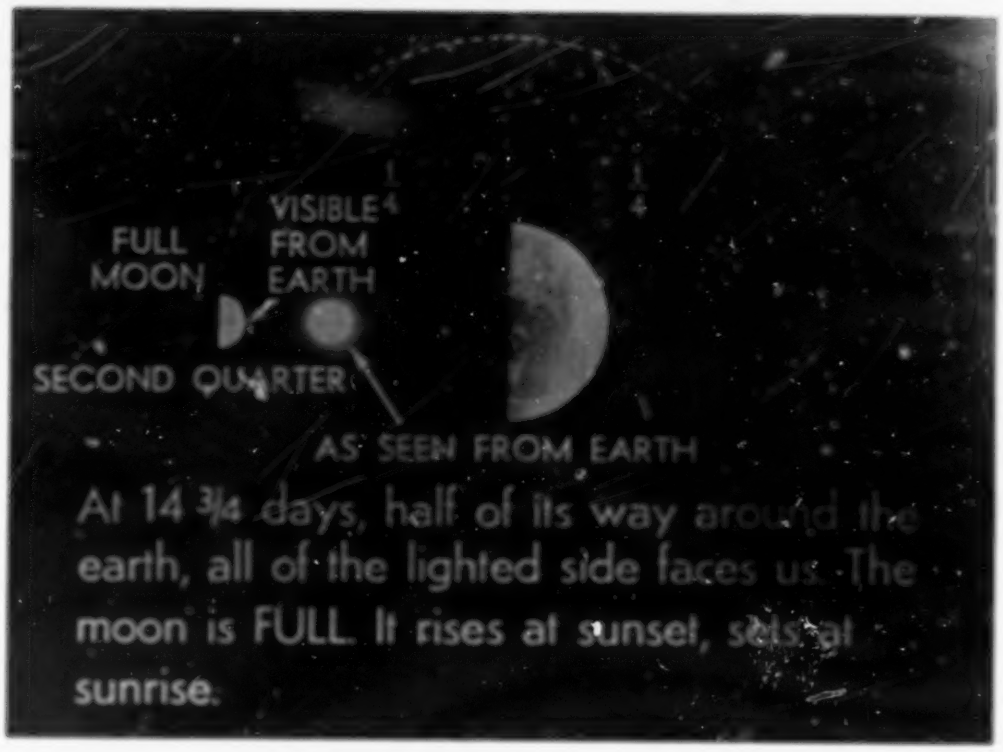

GIBBOUS MOON
(WAXING)
EARTH
SUN
20

At ten days the moon is GIBBOUS as $\frac{3}{4}$ of its lighted side faces us. It rises in the afternoon and sets after midnight.

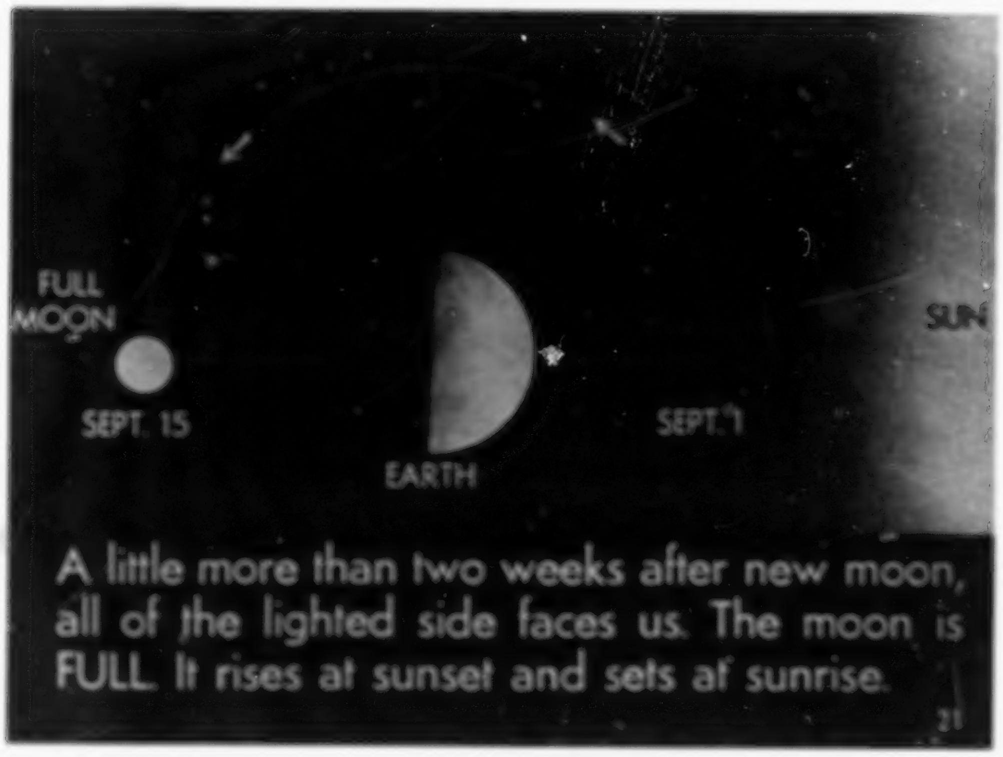
Frame #17

The revised frames dealing with the position in which the moon must be in relation to the earth and sun when the full moon phase occurs resulted in more complete learning in all three grades on Item 51. The improvement is significant in grade eight and senior high grades.

The FSR produced an improvement in identifying a diagram of the full moon in all grades, with a significant difference in grade five and senior high grades.


FULL MOON
VISIBLE FROM EARTH
$\frac{1}{4}$
$\frac{1}{4}$
SECOND QUARTER
AS SEEN FROM EARTH

At 14 ¾ days, half of its way around the earth, all of the lighted side faces us. The moon is FULL. It rises at sunset, sets at sunrise.


FULL MOON
SEPT. 15
EARTH
SEPT. 1
SUN

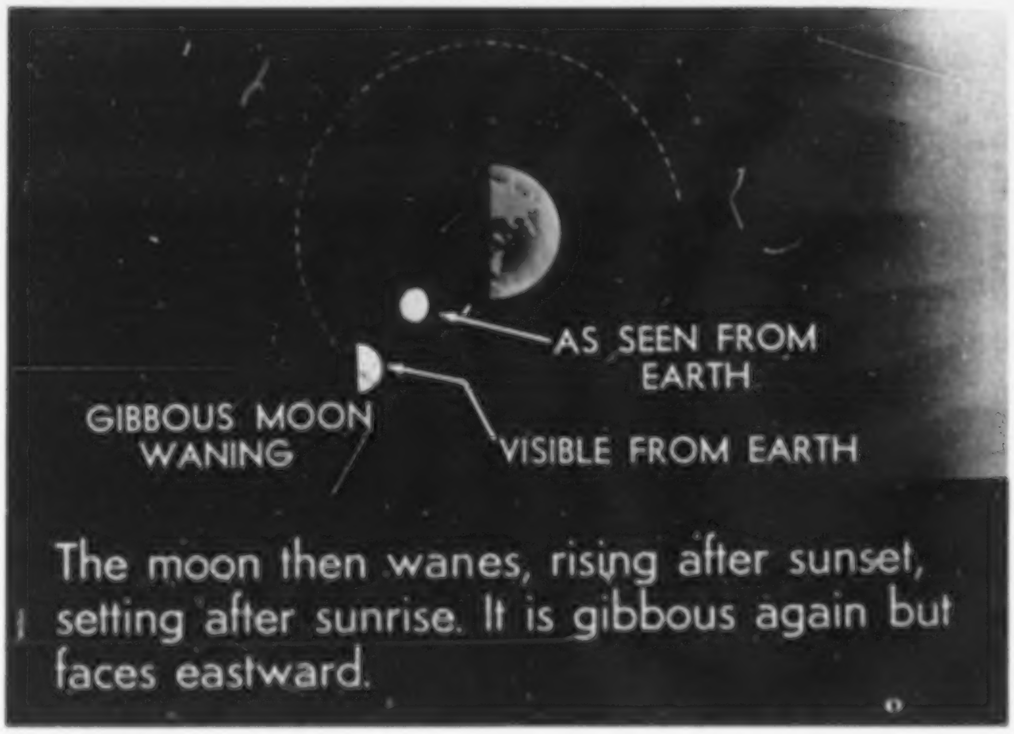
A little more than two weeks after new moon, all of the lighted side faces us. The moon is FULL. It rises at sunset and sets at sunrise.

21

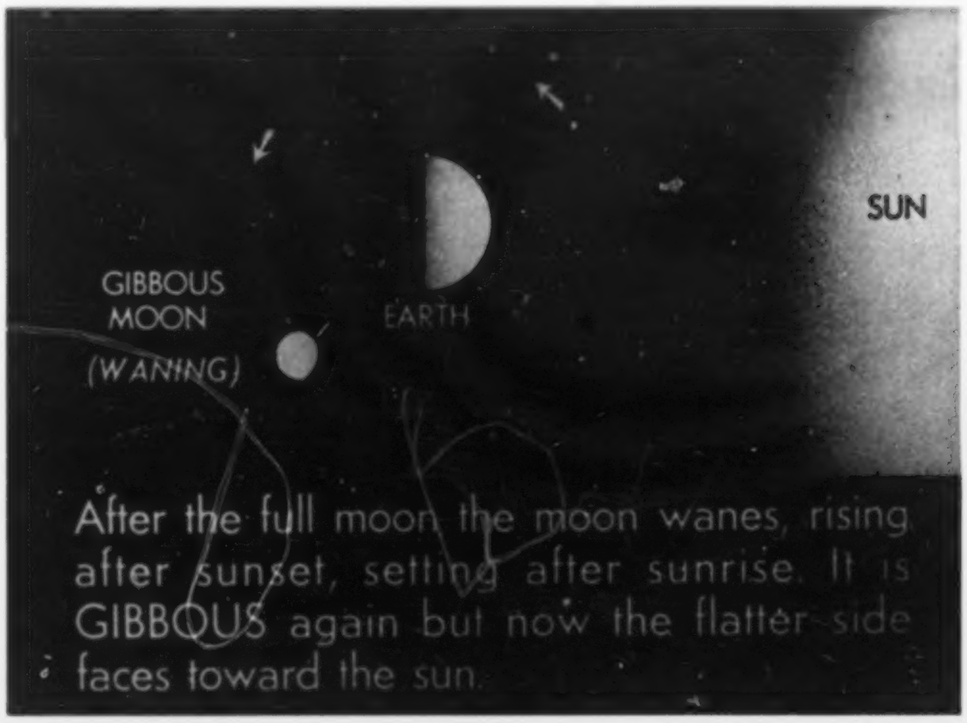
Frame #18

In FSO the flatter side of the gibbous moon faces toward the sun in the pictorial element, although the caption states the direction is eastward. In revising the FSR this apparent contradiction was resolved by eliminating one of the symbols representing the gibbous moon. As was expected, the FSR was significantly superior at all three levels tested on Item 55.

The FSR achieved learning improvement of the relative positions of earth, sun, and moon in the gibbous phase for all grade levels, but the differences were significant only in the senior high group.


AS SEEN FROM EARTH
GIBBOUS MOON WANING
VISIBLE FROM EARTH

The moon then wanes, rising after sunset, setting after sunrise. It is gibbous again but faces eastward.

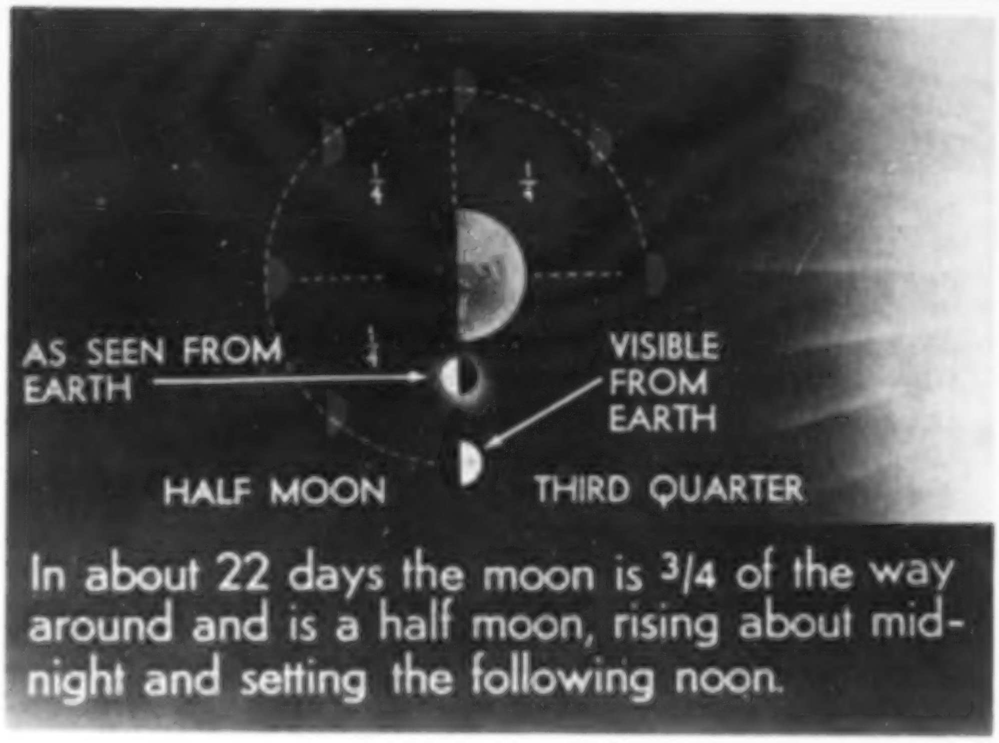

SUN
GIBBOUS MOON (WANING)
EARTH

After the full moon the moon wanes, rising after sunset, setting after sunrise. It is GIBBOUS again but now the flatter side faces toward the sun.

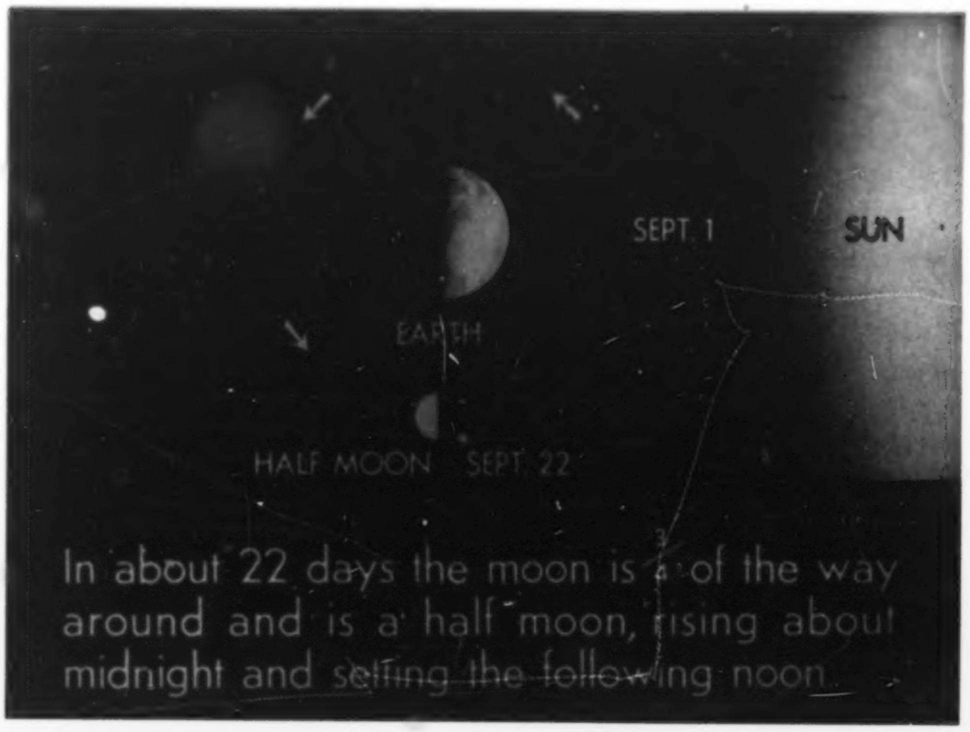
Frame #19

There were no verbal changes made in the revision of this frame. An attempt was made, however, to reinforce the verbal material by inserting dates in the pictorial element. This change appears to have made no significant contribution. Item 57 tested the awareness of number of days between the new moon and the three-quarter moon. The percentages on Table 10 show only slight differences in the senior high group favoring FSR. In grades five and eight the slight differences favor FSO.

Item 59 was used to test the knowledge of the way the moon looks at the three-quarter phase. The revision resulted in learning improvement for all three grades. The differences are not significant statistically, however.


1/4
1/4
1/4
AS SEEN FROM EARTH
VISIBLE FROM EARTH
HALF MOON
THIRD QUARTER

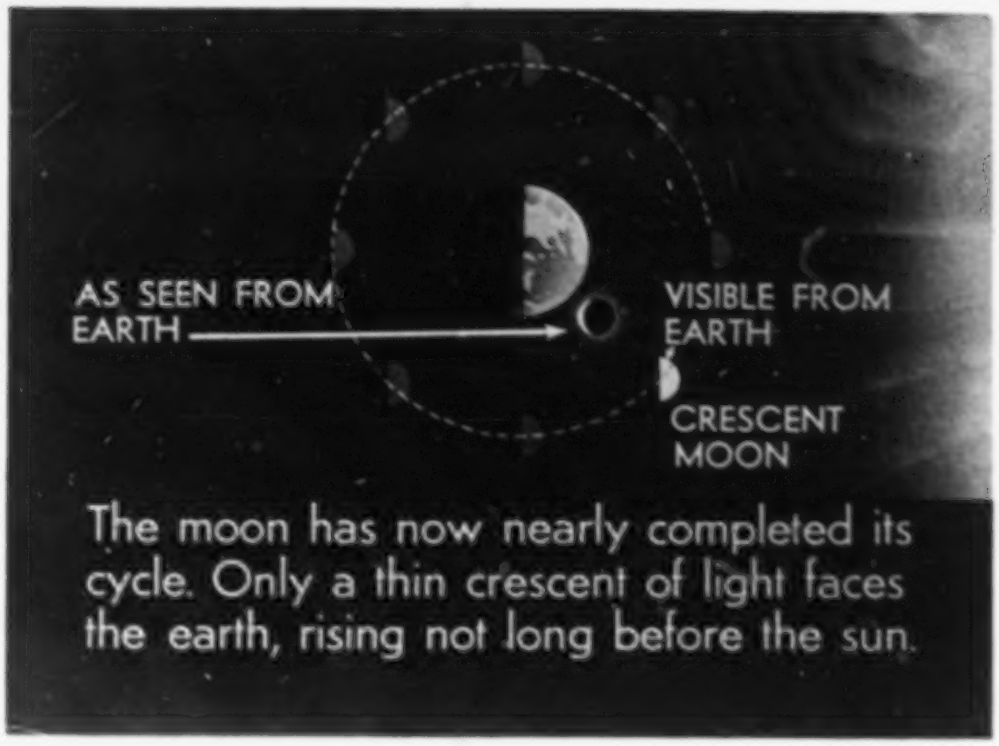
In about 22 days the moon is 3/4 of the way around and is a half moon, rising about midnight and setting the following noon.


SEPT. 1
SUN
EARTH
HALF MOON SEPT. 22

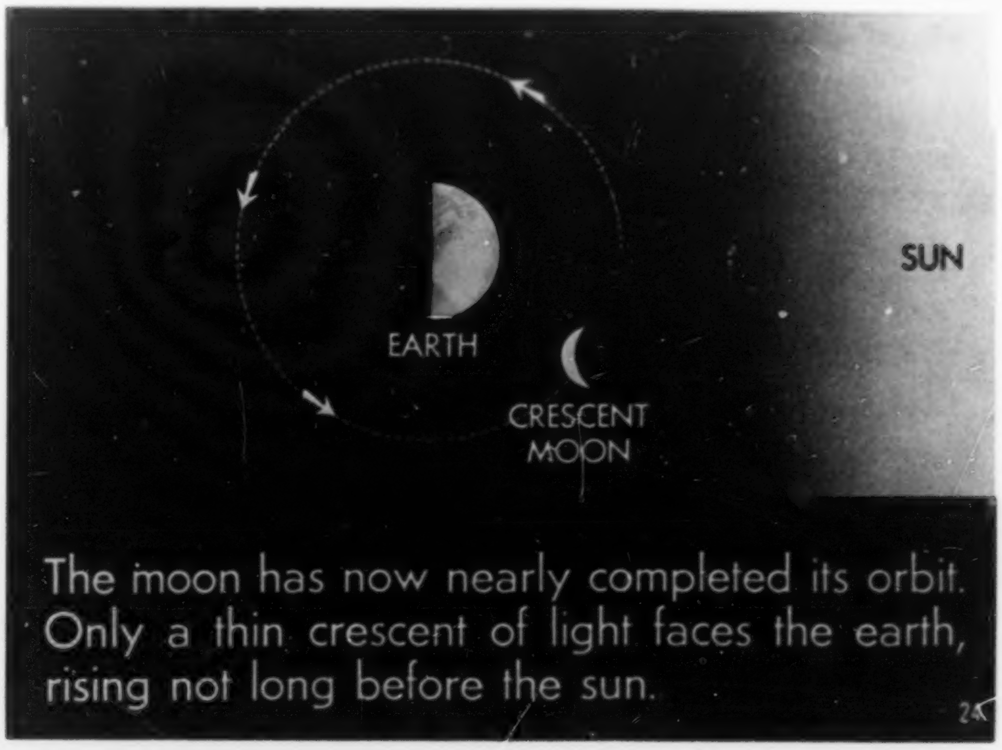
In about 22 days the moon is 3/4 of the way around and is a half moon, rising about midnight and setting the following noon.

Frame #20

Responses to Item 63, testing a knowledge the shape of the moon when it is near the end of its monthly cycle, shows that the simplicity and clarity of FSR resulted in greater learning in all grades. The improvement is not great enough to be statistically significant, however.


AS SEEN FROM EARTH
VISIBLE FROM EARTH
CRESCENT MOON

The moon has now nearly completed its cycle. Only a thin crescent of light faces the earth, rising not long before the sun.


SUN
EARTH
CRESCENT MOON

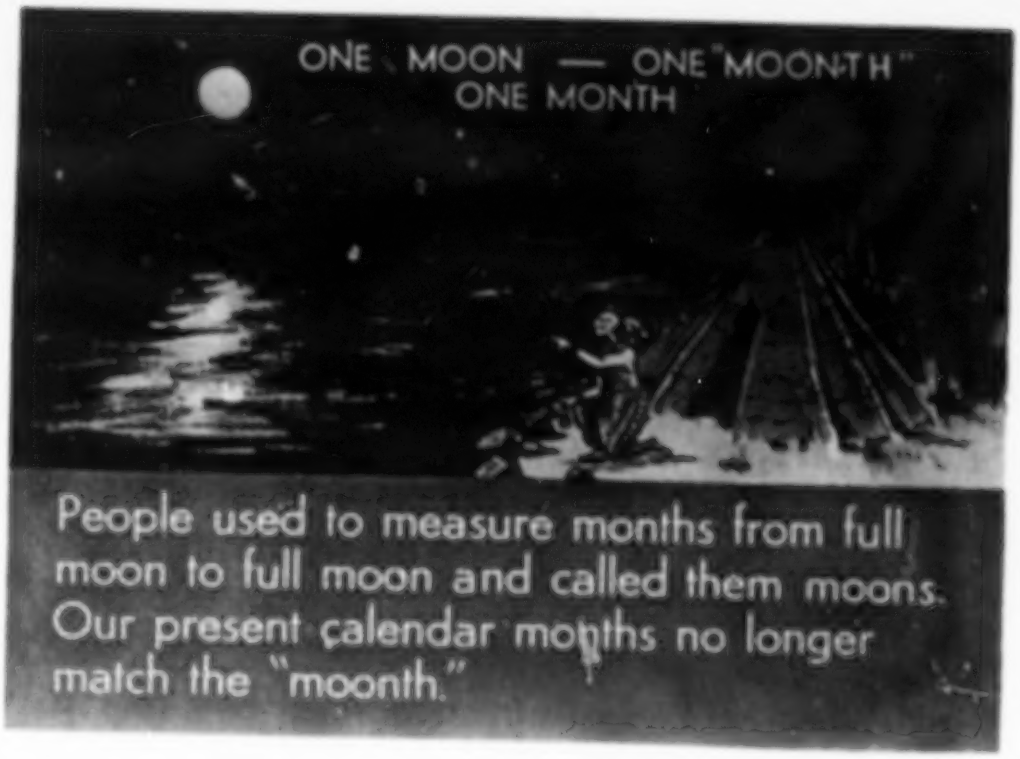
The moon has now nearly completed its orbit. Only a thin crescent of light faces the earth, rising not long before the sun.

24

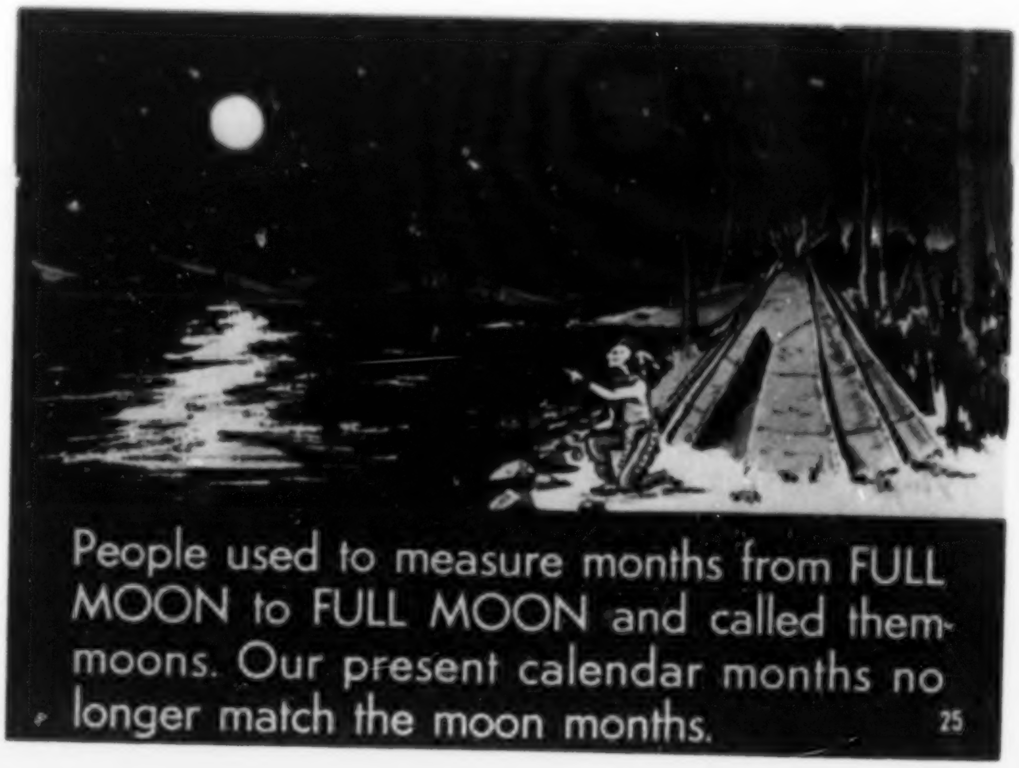
Frame #21

Both pictorial and verbal changes were made in the revision for Frame 21. The caption ONE MOON - 'MOONTH" ONE MONTH was removed from the top of the picture. The verbal material was reworded. The important concept that the origin of the term month came from the time from full moon to full moon as measured by Indian cultures was emphasized in FSR by using all capital letters.

Item 64 shows an improvement in learning for all three grades, but not at a statistically significant level.


ONE MOON — ONE "MOONTH"
ONE MONTH

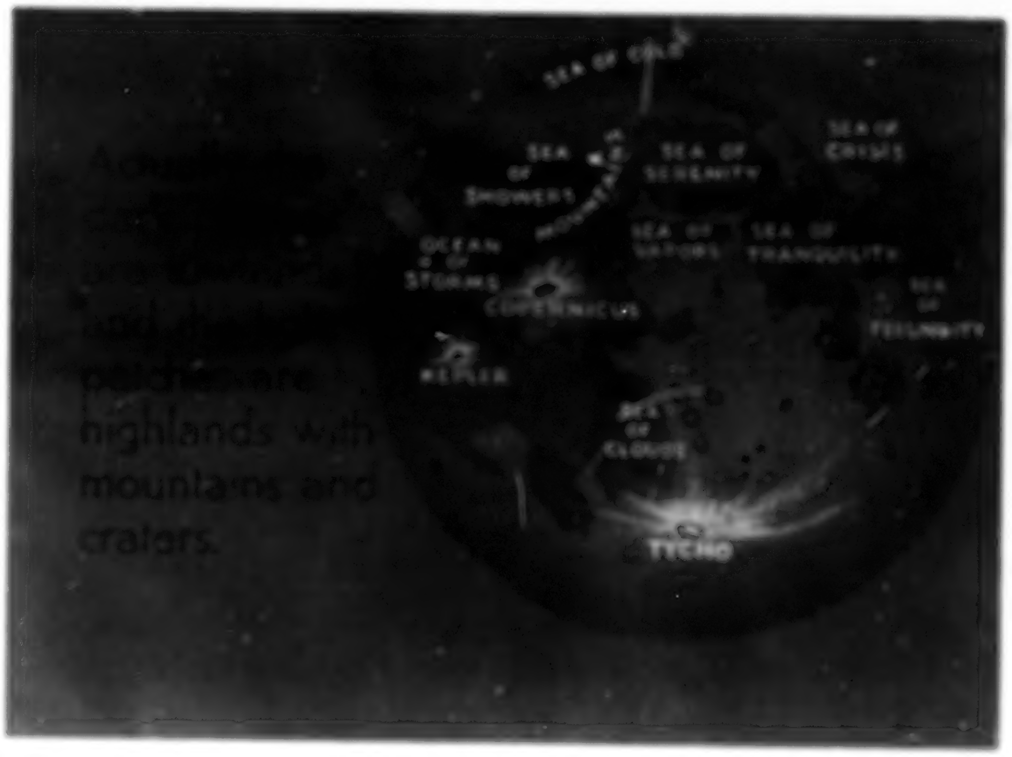
People used to measure months from full moon to full moon and called them moons. Our present calendar months no longer match the "moonth."

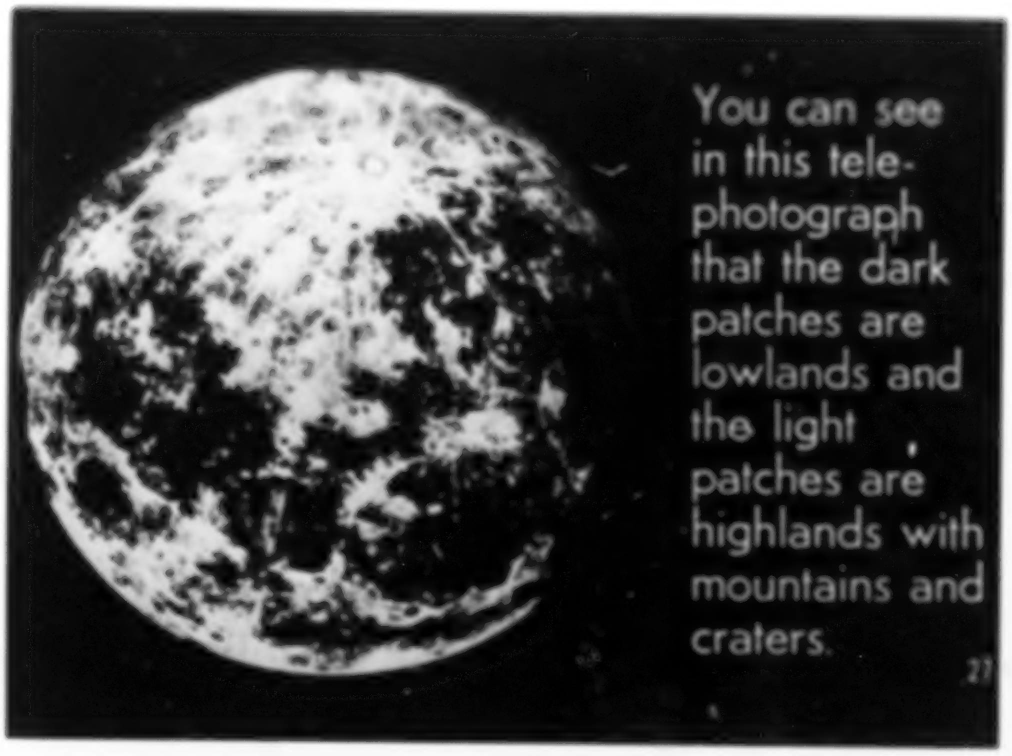


People used to measure months from FULL MOON to FULL MOON and called them moons. Our present calendar months no longer match the moon months.

Frame #24

The revision of Frame 24 consisted of substituting the presumably more iconic telephoto of the moon for a drawing, with labels. Also, the caption was changed by the introduction of personal reference. A greater proportion passed the item dealing with this frame in the revised version. The difference was consistently in favor of the revision at all grade levels, but statistical significance was achieved only in the upper elementary grades.


SEA OF COLD
SEA OF SHOWERS
MOUNTAINS
SEA OF SERENITY
SEA OF CRISIS
OCEAN OF STORMS
SEA OF VAPORS
SEA OF TRANQUILITY
SEA OF FECUNDITY
COPERNICUS
KEPLER
SEA OF CLOUDS
TYCHO
highlands with
mountains and
craters.



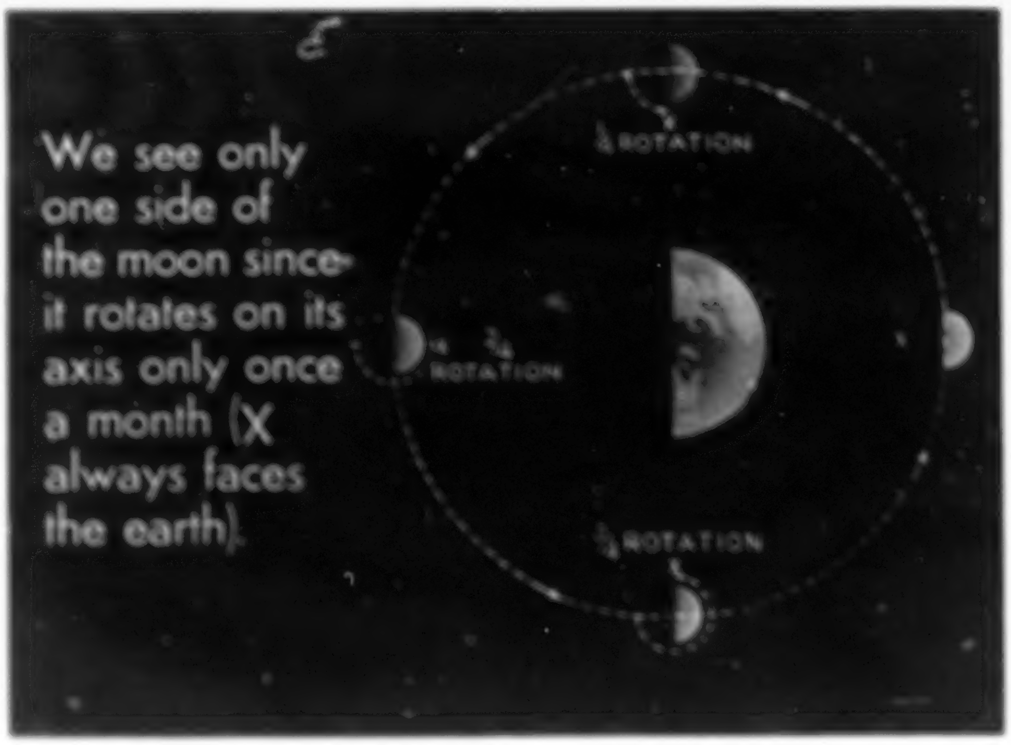
You can see in this telephotograph that the dark patches are lowlands and the light patches are highlands with mountains and craters.

Frame #25

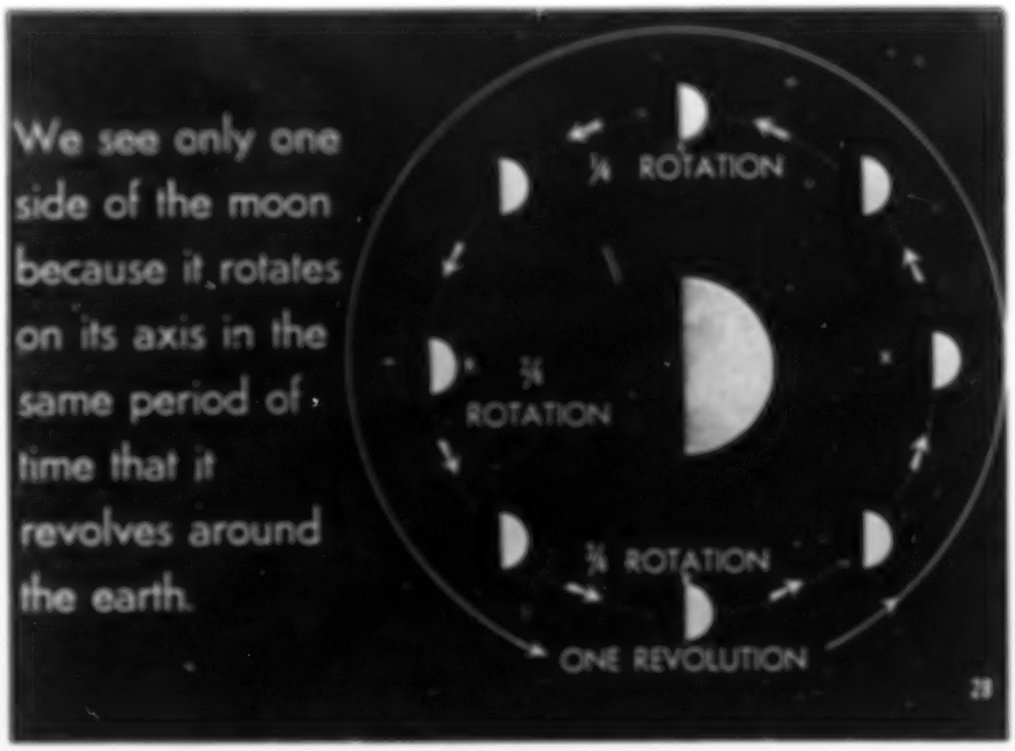
The verbal material in FSR was changed to explain more precisely the reason for seeing only one side of the moon. The pictorial element was changed by adding four extra moon positions and the words ONE REVOLUTION to the diagram.

Item 67 shows an improvement for FSR in grade five and senior high, but not a significant one. Evidently the FSO taught the relationship of the moon's rotation and revolution about as well as FSR.

The FSO appears to teach the concept of why we see only one side of the moon about as well as FSR. Item 68 reveals very little differences in grades five and eight favoring FSR. In the senior high group the non-significant difference favors FSO.


¼ ROTATION
2/4 ROTATION
¾ ROTATION

We see only one side of the moon since it rotates on its axis only once a month (X always faces the earth).

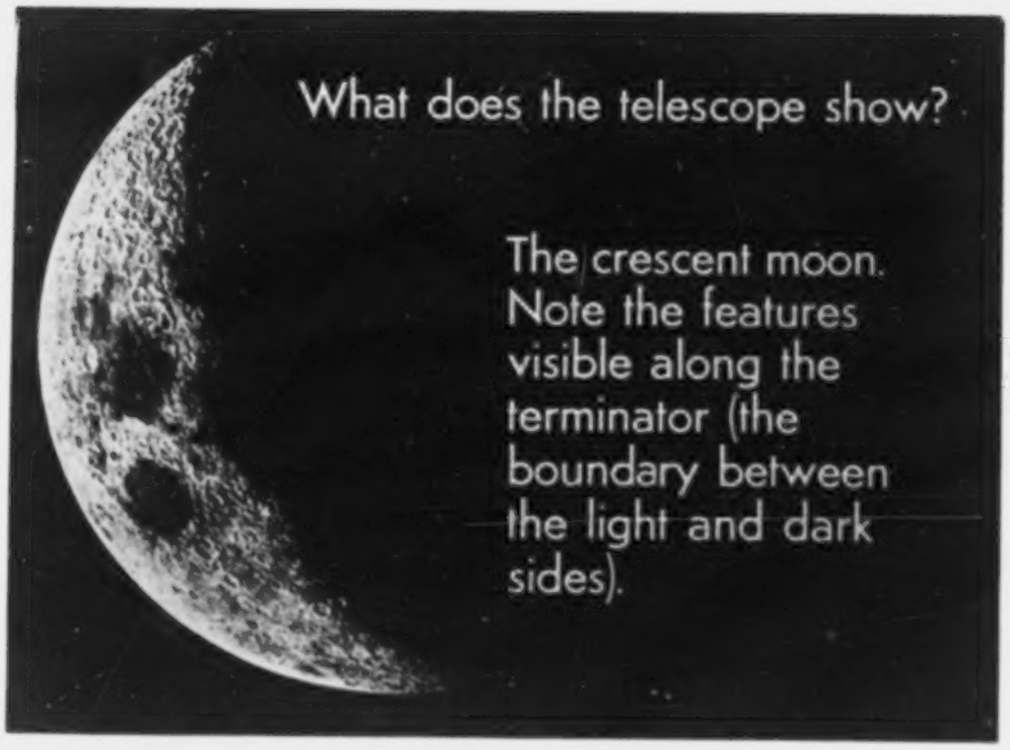

¼ ROTATION
2/4 ROTATION
¾ ROTATION
ONE REVOLUTION
28

We see only one side of the moon because it rotates on its axis in the same period of time that it revolves around the earth.

Frame #27

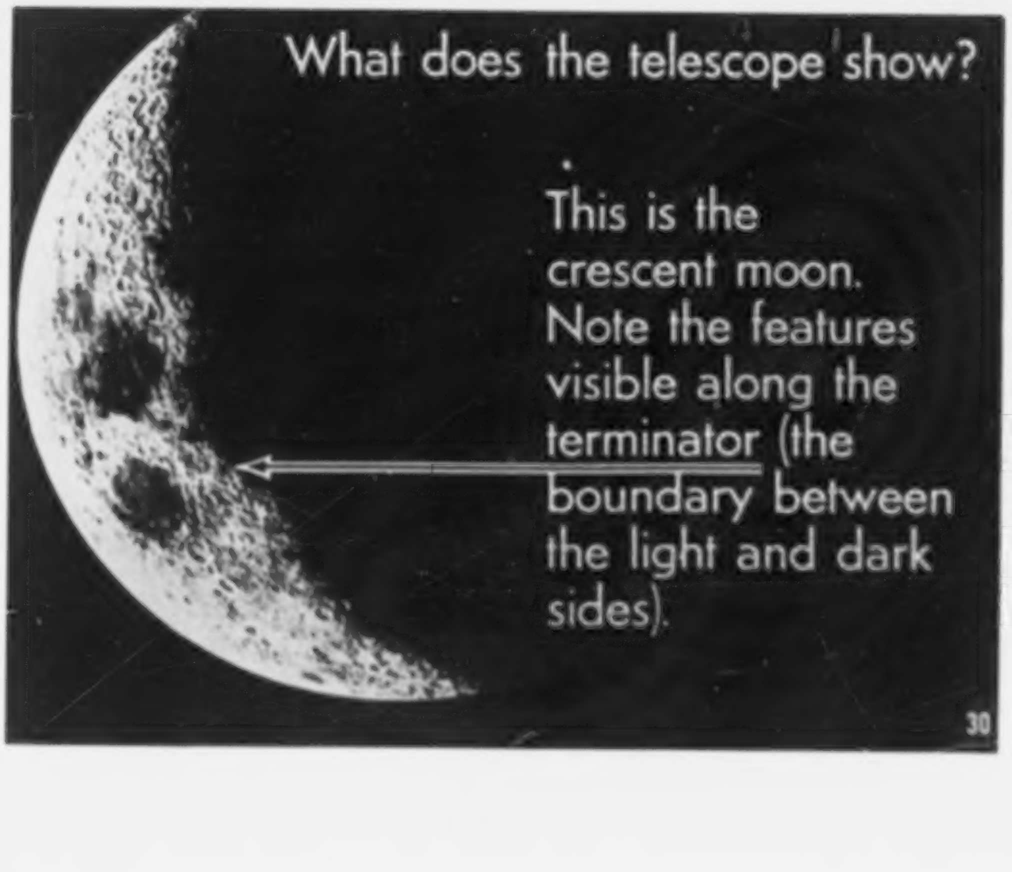
The changes in this frame were the addition of an arrow pointing out the terminator in the telephotograph of the crescent moon and the addition of the words "This is" to make a sentence out of the caption.

Item 70 tested for understanding of what the terminator really is. The addition of the arrow in FSR appears to have brought about clearer understanding in all grades tested, although the improvement is not statistically significant.



What does the telescope show?

The crescent moon. Note the features visible along the terminator (the boundary between the light and dark sides).



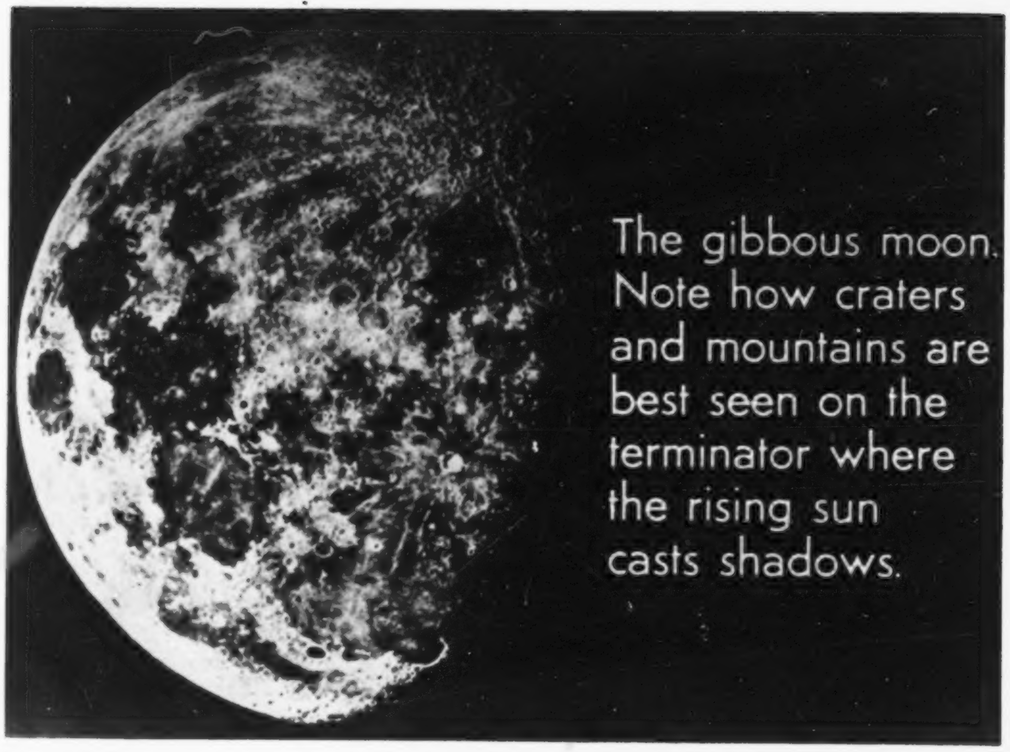
What does the telescope show?

This is the crescent moon. Note the features visible along the terminator (the boundary between the light and dark sides).

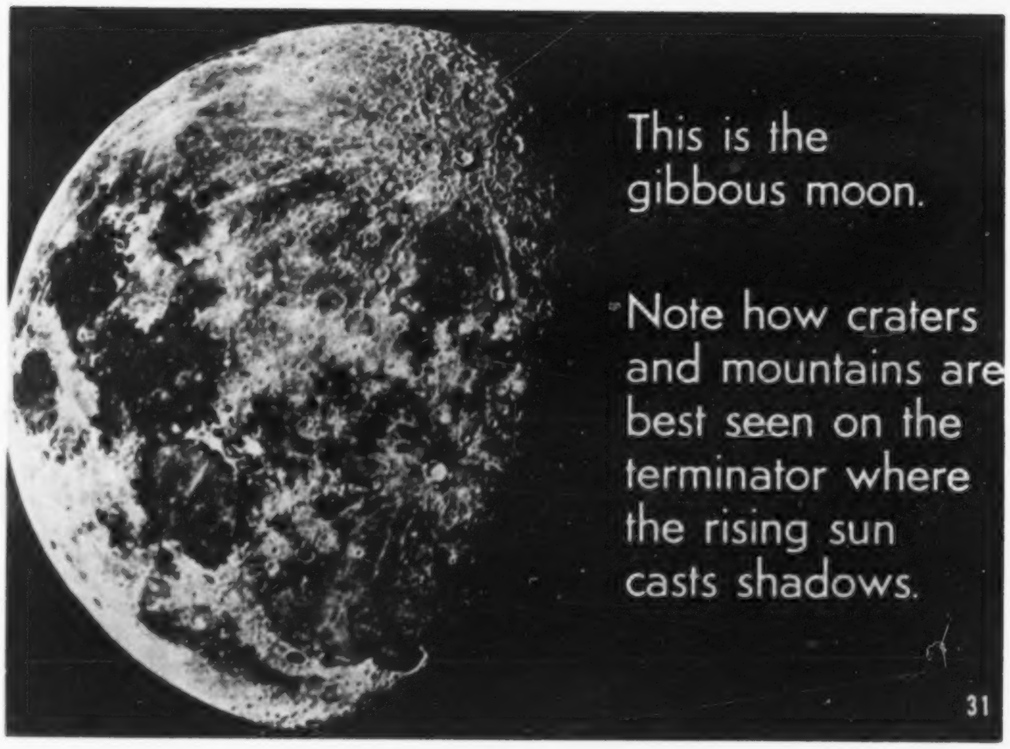
30

Frame #28

The only change made in FSR was at the beginning of the verbal material. The sentence "This is the gibbous moon" was used in place of the words "The gibbous moon". It seems that for some reason the FSO produced greater understanding in all grades as to why the terminator does not appear to be a smooth line in a telephotograph of the gibbous moon. The differences are rather small and may be due to chance factors, or they could result from the separation of the caption into two parts (a modification which was unintended by the investigators) which may have distracted attention from the information carrying part of the caption.



The gibbous moon.
Note how craters
and mountains are
best seen on the
terminator where
the rising sun
casts shadows.



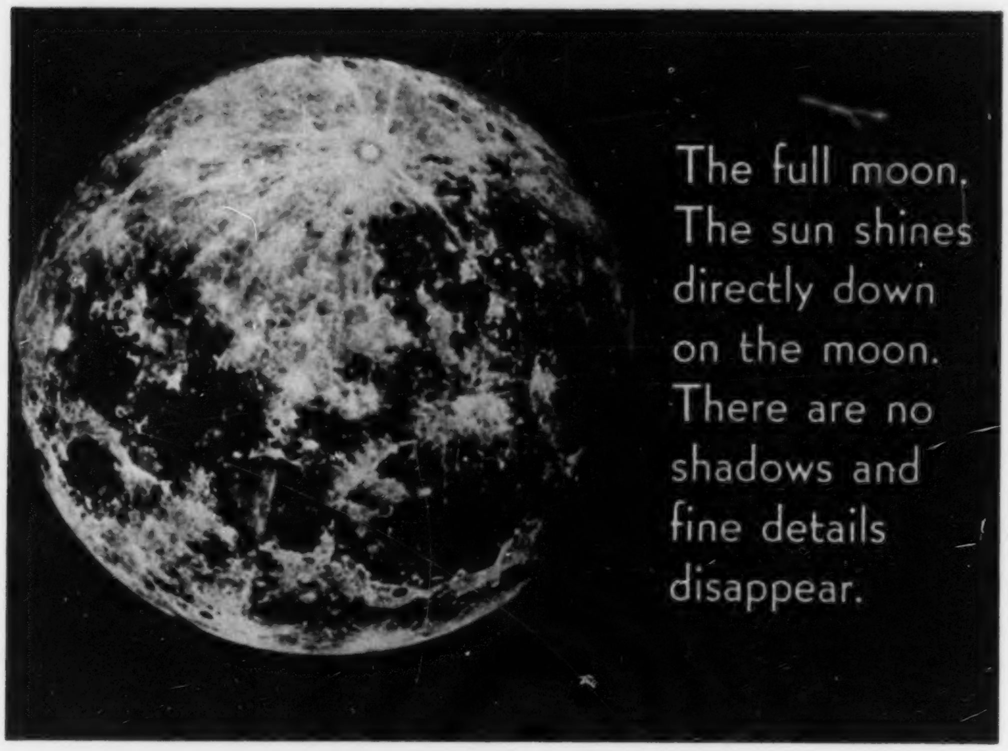
This is the
gibbous moon.

Note how craters
and mountains are
best seen on the
terminator where
the rising sun
casts shadows.

31

Frame #29

The only change made in FSR was the insertion of the word "appears" in the caption before the word "Sun". Nevertheless, the original version produced significantly more learning in grade five and non-significant differences in the same direction in the senior high group.



The full moon.
The sun shines
directly down
on the moon.
There are no
shadows and
fine details
disappear.

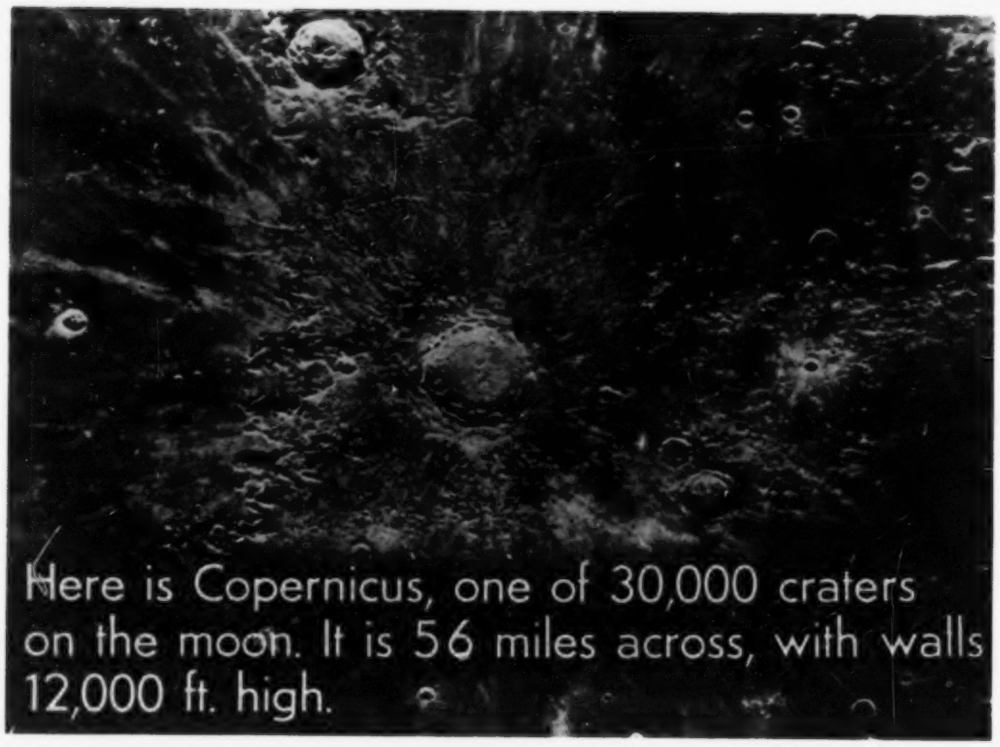
REVISED
FILMSTRIP
CAPTION

The full moon.

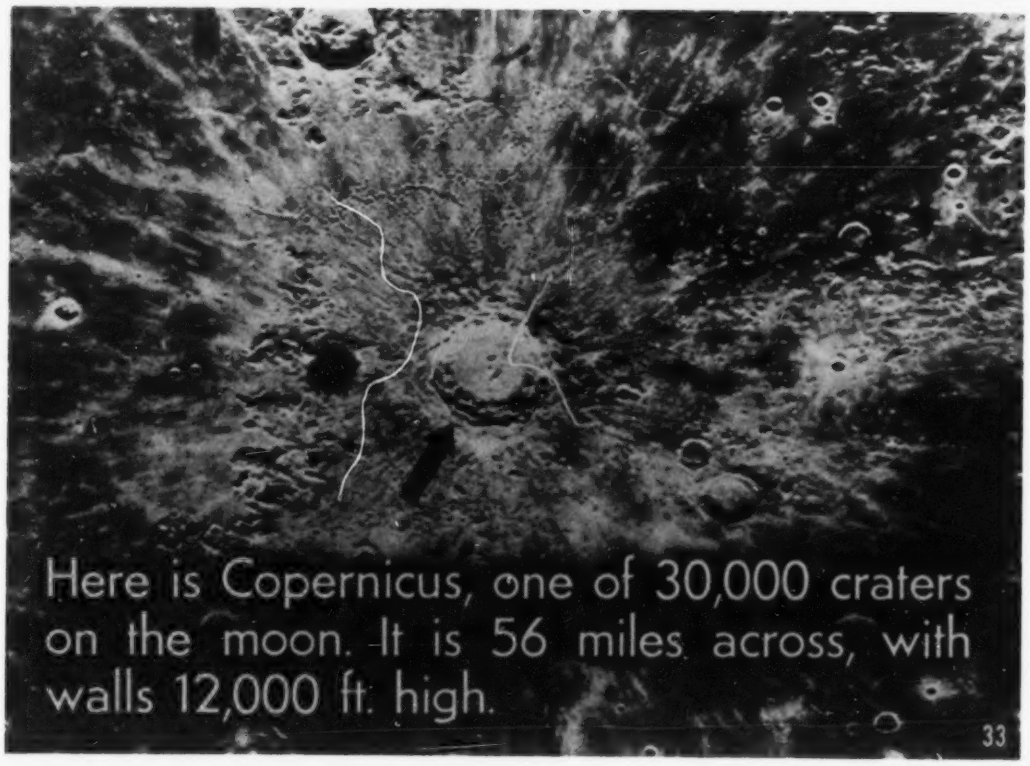
The sun appears
to shine directly
down on the moon.
There are no shadows
and fine details
disappear.

Frame #30

Changes were made in this frame to test the hypothesis that the addition of arrows to direct attention to the most important part of the pictorial element will reinforce the verbal material and thus result in improved learning. Item 75 which tests for identification of Copernicus in a photograph shows improvement for FSR for all three grades, although not at a level that is statistically significant. It seems that since the main point of interest, Copernicus, was near the center of the frame and that it is the largest crater shown, students learned to select it almost as well without the arrow that was added in FSR. The next frame better supports the hypothesized changes.



Here is Copernicus, one of 30,000 craters on the moon. It is 56 miles across, with walls 12,000 ft. high.



Here is Copernicus, one of 30,000 craters on the moon. It is 56 miles across, with walls 12,000 ft. high.

Frame #31

The FSR was altered to test the same hypothesis as Frame 30. However, in this case, the element of the picture that was to be pointed out was a mountain range which does not appear to be the center of interest in the telephotograph and which does not seem to be so obviously apparent, perhaps because it was not circular in form. The value of this technique is supported by the responses to Item 78 which reveal that FSR brought about improved learning in all grades tested and that in grades five and eight the improvement was significant at the .01 level.

There are many jagged mountain ranges on the moon. Here we see the Apennines, some of which rise 20,000 ft. above the plains.

There are many jagged mountain ranges on the moon. Here we see the Apennines, some of which rise 20,000 ft. above the plains.

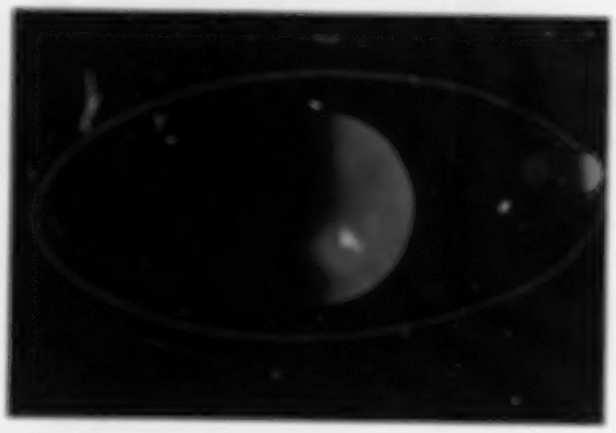
APPENDIX I

THE TEST GIVEN WITH PRESENTATIONS OF THE ORIGINAL AND REVISED FILMSTRIP: EARTH'S SATELLITE -- THE MOON

This is a test to determine what you learned from the filmstrip, EARTH'S SATELLITE -- THE MOON. Please do your best. Answer every question carefully. Follow the directions given on the answer sheet. Your test administrator will further explain the directions to you. Ask any questions you have _before_ the test begins.

DO NOT WRITE OR MARK ON THIS TEST BOOKLET

1. In the following frame from the filmstrip, tell what the larger object is.



   1. satellite
   2. sun
   3. star
   4. planet

2. A satellite can be best described by the term

   1. planet
   2. moon
   3. star
   4. sun

3. Satellites follow what direction around a planet?

   1. same direction as the hands of a clock
   2. always upward toward the sun
   3. opposite the direction of the hands of a clock
   4. always downward away from the sun

DO NOT TURN TO THE NEXT PAGE UNTIL YOU ARE TOLD

4. The planet with the greatest number of satellites is which of the following?
    1. Jupiter
    2. Pluto
    3. Venus
    4. Earth

5. Which planet appeared to be the smallest in size?
    1. Mercury
    2. Uranus
    3. Neptune
    4. Jupiter

6. A planet shown with rings around it is named
    1. Pluto
    2. Earth
    3. Saturn
    4. Mars

7. Pluto's satellites would number
    1. 2
    2. unknown
    3. 4
    4. 9

8. Give the number of Jupiter's satellites.
    1. 1
    2. 6
    3. 4
    4. 12

9. The number of known satellites is
    1. 9
    2. 39
    3. 15
    4. 31

10. Select the following planet that has no moon.
    1. Uranus
    2. Saturn
    3. Mercury
    4. Mars

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11. Which statement from the filmstrip best tells how moons came to be?

1. They just happened
2. Angels made them
3. They have always existed
4. No one knows

12. This photograph was used to illustrate what about a moon's beginning?

1. Moons may have been captured
2. Moons formed with planets
3. Moons may have formed from planets
4. None of these

13. This photograph was used to illustrate what about a moon's beginning?

1. No one knows
2. Formed with planets
3. May have been captured
4. Formed from planets

14. This photograph was used to illustrate what about a moon's beginning?

1. Moons may have been captured
2. Moons formed with planets
3. Moons may have formed from planets
4. None of these

DO NOT TURN TO THE NEXT PAGE UNTIL YOU ARE TOLD

15. Sometimes the moon is as close to the earth as

1. 222,000 miles
2. 93,000,000 miles
3. 100,000 miles
4. 2,380 miles

16. The earth's nearest neighbor is the

1. moon
2. sun
3. North Star
4. Mercury

17. The diameter of the moon compared with the earth is

1. 2 times larger
2. 1/4 as large
3. 1/2 as large
4. 4 times larger

18. The average distance the moon is from earth is

1. 238,000,000 miles
2. 238,000 miles
3. 220,000 miles
4. 253,000 miles

19. Which is the closest to the diameter of the moon?

1. 2,380 miles
2. 8,000 miles
3. 238,000 miles
4. 222,000 miles

20. What is the greatest distance that the moon is from earth?

1. 220,000 miles
2. 253,000 miles
3. 93,000,000 miles
4. 1,000,000 miles

DO NOT TURN TO THE NEXT PAGE UNTIL YOU ARE TOLD

21. What is the point where the moon is nearest the earth called?

1. apogee
2. perigee
3. perimeter
4. apology

22. The apogee of the moon's path around the earth is the

1. place the moon appears in the western sky
2. most distant point from earth
3. closest point to earth
4. average distance from earth

DO NOT TURN TO THE NEXT PAGE UNTIL YOU ARE TOLD

23. Why do the sun and moon seem to be the same size to us on earth?

1. The sun is 400 times larger and 400 times closer
2. The sun is 400 times larger and is 400 times farther away
3. The moon is 400 times larger and is 400 times farther away
4. The moon is 400 times larger and 400 times closer

DO NOT TURN TO THE NEXT PAGE UNTIL YOU ARE TOLD

24. The moon shines mainly because

1. it is on fire
2. it reflects sunlight
3. it is made of glowing matter
4. it has radium in its composition

25. Sometimes the darker part of the moon can be seen by

1. glowing ashes
2. forest fires on it
3. reflected earthlight
4. burning gases

DO NOT TURN TO THE NEXT PAGE UNTIL YOU ARE TOLD

26. The apparent size of the moon on the horizon is explained by

1. optical defects
2. nearsightedness
3. farsightedness
4. optical illusion

27. When it is rising or setting, the moon seems

1. smaller than when it is high in the sky
2. larger than when it is high in the sky
3. the same size as when it is high in the sky
4. sometimes larger and sometimes smaller than when it is high in the sky

DO NOT TURN TO THE NEXT PAGE UNTIL YOU ARE TOLD

28. The length of time that the moon is waxing is about

1. two months
2. two hours
3. two days
4. two weeks

29. The term waxing moon means that it

1. is in the last weeks of its orbit
2. is invisible because of clouds
3. is becoming more full each night
4. is becoming hotter each night

30. At the same hour each night the waxing moon appears

1. in the same position in the sky
2. larger in the same position in the sky
3. in a different position in the sky
4. a different color in the same position in the sky

31. Which would look the most like the full moon?

1. crescent moon
2. gibbous moon
3. half moon
4. new moon

DO NOT TURN TO THE NEXT PAGE UNTIL YOU ARE TOLD

32. The waning moon phases take place during what period of time?

1. First two months of its orbit
2. Second two months of its orbit
3. First two weeks of its orbit
4. Second two weeks of its orbit

33. The term that describes the moon's lighted part becoming less full is which of the following?

1. crescent
2. waxing
3. gibbous
4. waning

34. A waning moon is seen

1. at noon and in the early afternoon
2. late at night and in the early morning hours
3. immediately after sunset only
4. after sunrise

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35. The moon is a globe revolving around the earth about how often?

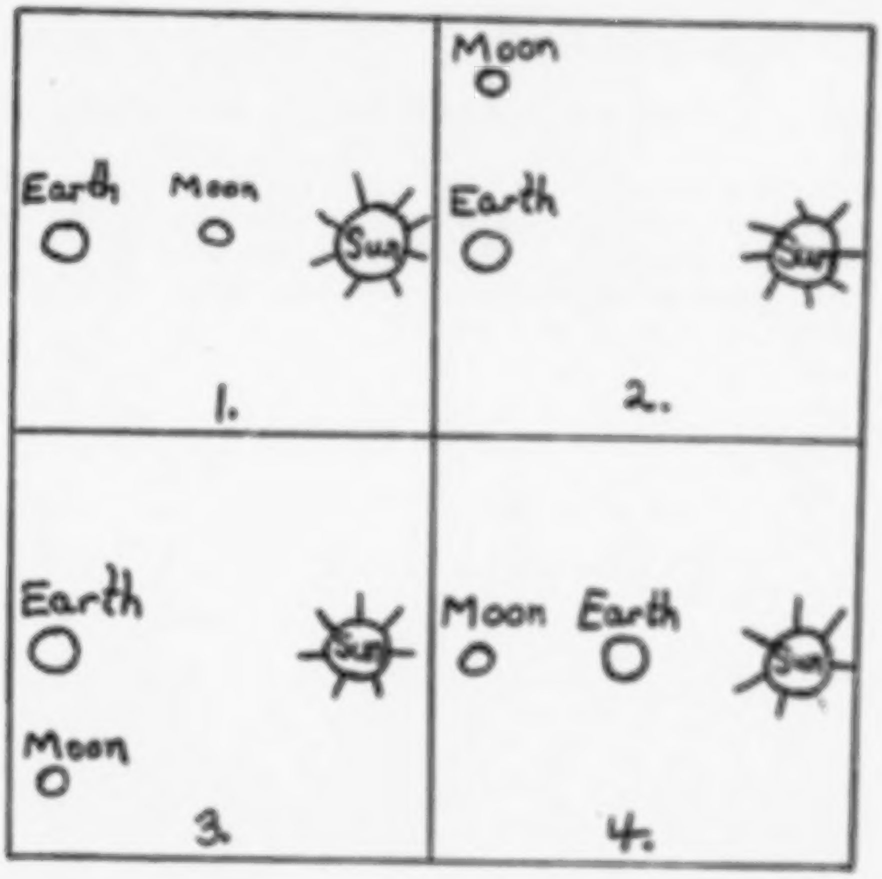
1. once every day
2. once every year
3. once every century
4. once every month

36. Which statement describes the sunlight falling on the moon?

1. the sunlight strikes nearly the whole surface at once.
2. the sunlight strikes three fourths of the surface at once.
3. the sunlight strikes about one half of the surface at once.
4. the sunlight strikes one fourth of the surface at once.

DO NOT TURN TO THE NEXT PAGE UNTIL YOU ARE TOLD

37. Select the diagram that best represents the position of sun, moon, and earth during the new moon phase.


Earth
Moon
Sun
1.
Moon
Earth
Sun
2.
Earth
Sun
Moon
3.
Moon
Earth
Sun
4.

38. The new moon as seen from earth

1. always has a halo around it
2. is invisible in the sunlight
3. is nearly as bright as the sun
4. is much larger than the other phases

39. The phase of the moon when it is directly between the earth and sun is which of the following?

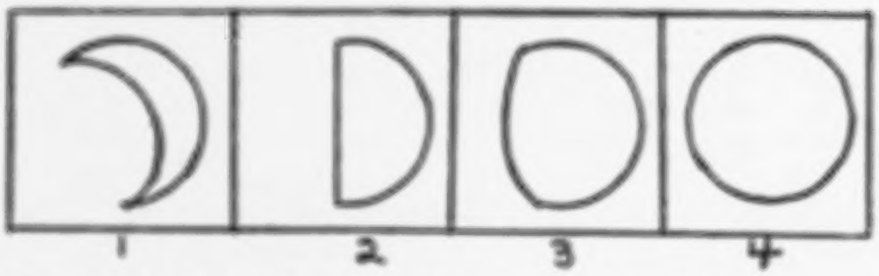
1. full moon
2. new moon
3. crescent moon
4. gibbous moon

DO NOT TURN TO THE NEXT PAGE UNTIL YOU ARE TOLD

40. What is the very next phase that follows a new moon?

1. full moon
2. half moon
3. crescent moon
4. gibbous moon

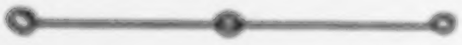
41. Choose the diagram that shows a crescent moon.

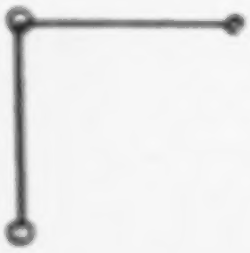


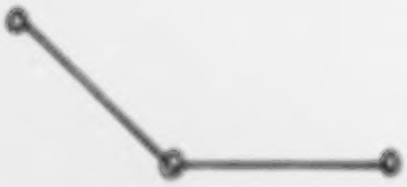
42. About how long does it take the moon to go from new moon to crescent moon?

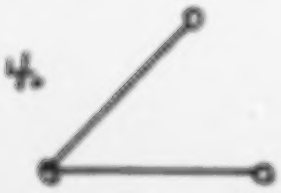
1. 10 days
2. 1 week
3. 3½ days
4. 5 days

43. Which of the following angles represents the positions of the sun, earth, and moon during the crescent moon?

1.


2.


3.


4.


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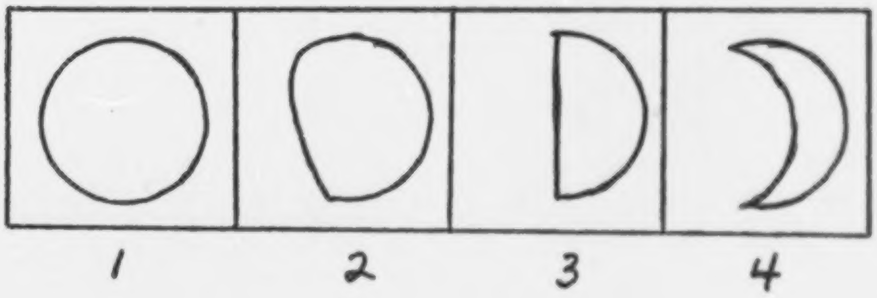
44. The time the moon takes to reach first quarter from new moon is about

1. one year
2. one day
3. one month
4. one week

45. If the moon is new on October 1, what phase would occur on October 3?

1. full moon
2. crescent moon
3. half moon
4. gibbous moon

46. The moon as seen from earth at first quarter is shown by which of the following?



47. How much of the lighted side of the moon do we see at first quarter?

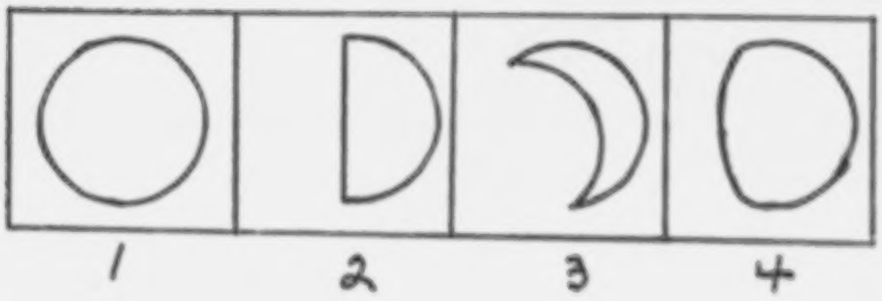
1. one-fourth
2. one-half
3. three-fourths
4. all of it

DO NOT TURN TO THE NEXT PAGE UNTIL YOU ARE TOLD

48. During the gibbous moon phase the amount of the lighted side facing earth is about how much?

1. 1/4
2. 3/4
3. 1/2
4. all of it

49. Pick the diagram that shows the waxing gibbous moon as "seen from earth".



50. Seeing the waxing gibbous moon rising is difficult because it

1. rises at midnight
2. rises at sunrise
3. rises in the morning
4. rises in the afternoon

DO NOT TURN TO THE NEXT PAGE UNTIL YOU ARE TOLD

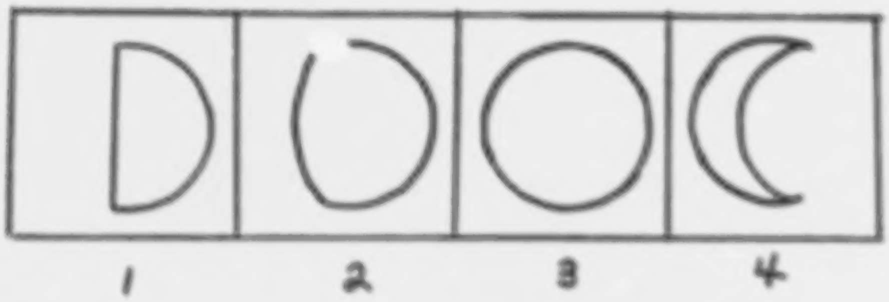
51. What is the position of the sun, earth, and moon during the full moon phase?

1. The moon is between the earth and sun.
2. The earth is between the sun and moon.
3. The sun is between the earth and moon.
4. The moon, sun and earth form a right angle.

52. When the moon is full, it has travelled how far around the earth since the new moon?

1. all of the way
2. one fourth of the way
3. half of the way
4. three fourths of the way

53. One diagram illustrates the full moon "as seen from earth". Choose it.



54. During the full moon phase the moon rises at what time?

1. sunrise
2. sunset
3. midnight
4. noon

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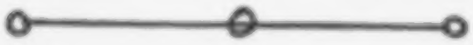
55. After the full moon phase, which way does the flatter side of the gibbous moon face?

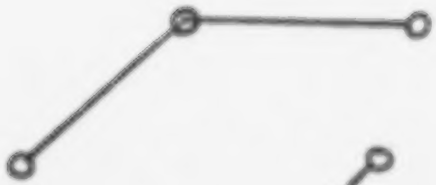
1. away from the sun
2. at right angles to the sun
3. slanting toward the sun
4. toward the sun

56. Which of the following angles represents the positions of the sun, earth, and moon during the gibbous moon phase?

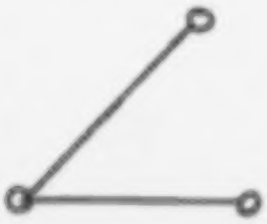
1.



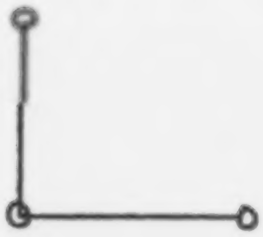
2.



3.



4.



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57. It takes the moon about how many days to go 3/4 of the way around the earth?

1. 30
2. 28
3. 26
4. 22

58. During the third quarter the moon rises about what time?

1. noon
2. midnight
3. sunrise
4. sunset

59. The phase of the moon when it is 3/4 of the way around the earth from new moon is

1. crescent moon
2. gibbous moon
3. full moon
4. half moon

DO NOT TURN TO THE NEXT PAGE UNTIL YOU ARE TOLD

60. As the moon nearly completes its cycle, the amount of light facing the earth is how much?

1. a thin crescent
2. one fourth of the surface
3. one half the surface
4. all of it

61. The phase of the moon changes about once every

1. week
2. 3 1/2 days
3. day
4. 2 days

62. Altogether the moon goes through how many separate phases when it makes one revolution?

1. four
2. six
3. two
4. eight

63. What is the shape of the visible part of the moon when it rises just before sunrise?

1. a thin crescent
2. half moon
3. gibbous moon
4. full moon

DO NOT TURN TO THE NEXT PAGE UNTIL YOU ARE TOLD

64. The Indian "month" measured what period of time?

1. from new moon to full moon
2. from new moon to last quarter
3. from full moon to full moon
4. from full moon to new moon

DO NOT TURN TO THE NEXT PAGE UNTIL YOU ARE TOLD

65. What can we see on the moon with our bare eyes or binoculars?

1. light and dark patches
2. people and animals
3. lakes and streams
4. rivers and oceans

DO NOT TURN TO THE NEXT PAGE UNTIL YOU ARE TOLD

66. The dark patches on the moon are really what?

1. highlands
2. lowlands
3. mountains
4. craters

DO NOT TURN TO THE NEXT PAGE UNTIL YOU ARE TOLD

67. Which statement best shows the relationship between the moon's revolution and its rotation?

1. It rotates once during each revolution
2. It rotates once during each two revolutions
3. It rotates three times during each revolution
4. It rotates four times during each revolution

68. Why do we see only one side of the moon?

1. Because it rotates three times during each revolution
2. Because it rotates twice during each revolution
3. Because it rotates any number of times during each revolution
4. Because it rotates once during each revolution

DO NOT TURN TO THE NEXT PAGE UNTIL YOU ARE TOLD

69. The astronomical telescope shows objects to appear how?

1. erect
2. as the eye sees them
3. reversed
4. upside down

DO NOT TURN TO THE NEXT PAGE UNTIL YOU ARE TOLD

70. The terminator in a photo of the crescent moon through a telescope is really what?

1. the mountainous rough parts
2. the dark portion of the moon
3. the moon's atmosphere
4. the boundary between light and dark sides

DO NOT TURN TO THE NEXT PAGE UNTIL YOU ARE TOLD

71. The mountains and craters on the moon are seen in fine detail through a telescope under what conditions?

1. when the moon is gibbous or crescent
2. when the moon is full or new
3. only when the moon is new
4. only when the moon is full

72. Why does not the terminator in a telephotograph appear to be a smooth line on the moon?

1. because of an optical illusion
2. because no telescope is perfect
3. because of forests and other growths
4. because of mountain and crater shadows

DO NOT TURN TO THE NEXT PAGE UNTIL YOU ARE TOLD

73. During a full moon which of the following is true?

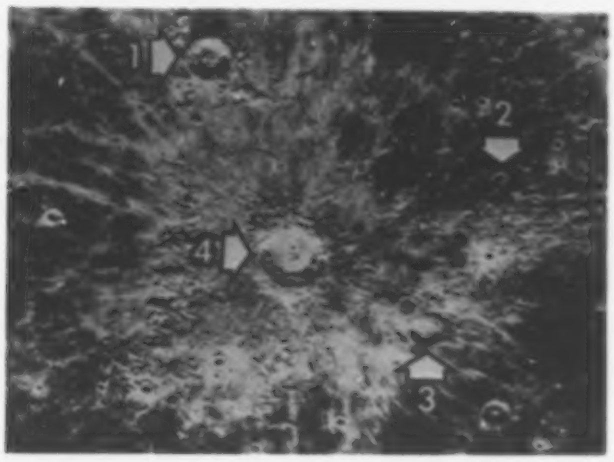
1. There are some shadows on the moon.
2. The sun shines directly down on the moon.
3. There is not much reflection of light.
4. Fine details do not disappear.

DO NOT TURN TO THE NEXT PAGE UNTIL YOU ARE TOLD

74. What is the number of craters scientists believe exist on the moon?

1. 30,000
2. 56
3. 12,000
4. 138,000

75. Which is Copernicus in the following photograph?



76. What is the distance across Copernicus?

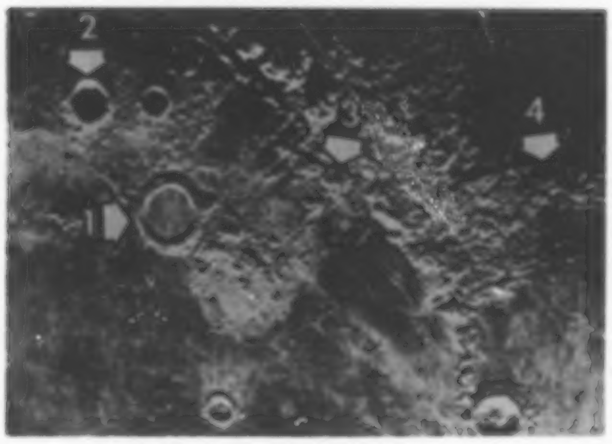
1. 12,000 feet
2. 30,000 feet
3. 56 feet
4. 56 miles

77. Copernicus is the name of which of the following on the moon?

1. a crater
2. a mountain range
3. a sea
4. a plain

DO NOT TURN TO THE NEXT PAGE UNTIL YOU ARE TOLD

78. Which of the following is a mountain range on the moon shown through a telescope?



79. Which of the following is a mountain range on the moon?

1. Appalachian
2. Rockies
3. Apennines
4. None of these

STOP!!

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APPENDIX II

RECOMMENDATIONS FOR THE FIRST REVISION OF FILMSTRIP "EARTH'S SATELLITE - THE MOON" BY FRAME OF FSO

Frame I.

A. Pictorial

1. Label the planet and satellite.

2. Change the orbital path to be more oval and to give the perspective of being seen on a plane nearer the earth's plane.

3. Make the arrow showing the satellite direction larger and add one more so that there will be one on each side of orbital path.

B. Verbal

1. Underline the word "moons".

Frame II.

A. Pictorial

1. Change zero under Mercury and Venus to word NONE.

2. Change the zero (?) under Pluto to UNKNOWN.

3. Group the moons for each planet into some mathematical arrangement that can be perceived at a glance.

B. Verbal - no change

Frame III.

A. Pictorial changes

1. Make three separate frames from this one:

a. One frame to show a planet having a moon pulled from it by a passing star (make certain the star looks like a star by being completely bright). Use wavy lines to illustrate force of gravity.

b. The second frame shall retain the pictorial element of number two (2) or original with some artistic modifications.

c. The third frame shall show a labelled planet in a dotted path pulling by gravity a moon from its normal path (shown also by dotted lines).

B. Verbal

1. The first frame shall bear this caption - "No one knows how moons came to be. They may have been formed by being pulled from planets by the force of gravity of a passing star....

2. Second frame caption shall be - ...or they may have been formed with the planets during the time the rest of the solar system was forming...

3. ...or they may have been bodies in space whose paths brought them close enough to be captured by a planet.

Frame IV.

A. Pictorial

1. Make orbital circle more nearly round and put 253,000 miles on left side and 222,000 miles on right. At the top, representing the average distance, put 238,000 miles.

2. Label the earth and moon.

3. Change from two moons to one moon in the 253,000 miles area.

4. Try to make larger labels for better visibility when projected on the screen.

5. Round moon diameter figures to 2,000 miles.

6. Use dotted lines to help compare diameter of earth and moon.

B. Verbal - Verbal material shall remain the same as FSO.

Frame V.

A. Pictorial

1. Remove earth and moon diameters.

2. Label earth and moon.

3. Make distance figures larger.

4. Omit one moon.

5. Put words perigee and apogee over or under the appropriate distance figures in label.

B. Verbal - Verbal material shall remain as in FSO

Frame VI.

A. Pictorial - Pictorial material shall be improved by some method of making the circle of sun darker.

B. Verbal - Verbal material shall be changed to eliminate vague reference pronoun "it". Use the following caption: The sun is 400 times farther away, so they both appear to be the same size.

Frame VII.

A. Pictorial - Pictorial material shall be changed only by removing bright spots in darker part of crescent moon.

B. Verbal - Verbal material shall remain as it appears in FSO.

Frame VIII.

A. Pictorial

1. The moon in the rising position shall be made slightly larger and the moon overhead shall be made slightly smaller than in FSO.

2. Change word large to larger and small to smaller.

B. Verbal - Verbal material shall remain as it appears in FSO.

Frame IX. This frame shall be made into two frames.

1 A. Pictorial for first of two frames made from FSO frame nine

1. Add the word PHASES after term waxing moon.
2. Make the new moon phase invisible with an arrow marking where it is located in the sky, and word invisible in parenthesis.
3. Do away with dark parts in the phases shown for greater realism.
4. Label the phase under each moon in its phase.
5. Make arrows more prominent.

B. Verbal - Verbal for FSO frame nine shall be as follows: The WAXING moon becomes more full each night during the first two weeks of its monthly trip around the earth.

2 A. Pictorial - Pictorial material for second frame of FSO frame nine.

1. Use same moon phases as first frame except do not include labels.
2. Use words Eastern sky and Western sky in place of E. and W. as in FSO.
3. Insert the following dates for the appropriate phases of the moon across the sky: Sept. 4th for the crescent; Sept. 8th for the half moon; Sept. 12th for the gibbous moon; Sept. 15th for the full moon.
4. Once each phase shown put 8 p.m.
5. No date should be inserted under the new moon position.

B. Use the following caption: The moon rises about 50 minutes later each night. If you look for it at 8 p.m. on successive nights it will be in a different position in the sky.

Frame X. Make into two frames.

1 A. Pictorial material shall be changed as follows:

1. Add word PHASES after waning moon.
2. The new moon shall be made invisible, but omit arrow pointing to its location. The label is sufficient.

3. Do away with the darker parts of each phase for greater realism.

4. Label the phase under each moon.

5. Make arrows more prominent.

B. Verbal material shall be one sentence. "The WANING moon becomes less full each night during the second two weeks."

2 A. Pictorial part shall be the same as the first portion except labels of phases will be omitted.

1. Use words Eastern sky and Western sky in place of E and W.

2. Insert the following dates under the phases: Sept. 15th for the full moon; Sept. 18th for the gibbous moon; Sept. 22nd for the half moon; Sept. 25th for the crescent moon.

3. Insert the time 3 a.m. under each phase shown.

4. No date or time shall be put under the new moon position.

B. The caption shall be - The WANING moon is seen late at night and in the early morning before sunrise.

Frame XI.

A. Pictorial changes.

1. Change the question at the top of the frame to read: "Why does the moon have phases?"

2. Make the earth and moons appear more like spheres by shading.

3. Increase prominence of arrows in orbital path.

4. Add extra moon positions in orbit to reveal actual number of phase positions - a total of eight.

5. Add figures three and a half days between the phases in orbit.

6. Label sun and use arrow pointing to the bright section of frame at right.

B. The verbal material shall remain as in FSO.

Note: After the frame on why the moon has phases. Use a frame to introduce the following sequence on each separate phase as an improvement over FSO.

A. The Pictorial material should have the earth in the center. And be exactly like the foregoing frame except the eight moon positions should be labeled and the three and a half days figures shall be omitted.

B. The caption shall be worded as follows: As the moon revolves around the earth, the amount of the moon's surface that is visible from earth changes. (FSR frame 16).

Frame XII.
(FSO)

A. Pictorial element changes

1. Objects must have labels - sun, earth, and moon.

2. Omit the arrow and words as seen from earth.

3. Omit (not to scale)

4. Omit the extra moon and make the diagram agree with the caption. The new moon is invisible; therefore, leave no moon be shown. Instead place the words "Position of New Moon" and use date of Sept. 1st.

B. Verbal material shall be the same as in FSO. (FSR frame 17)

Frame XIII.

A. Pictorial shall be changed as in numbers (1), (2), and (4) of FSO frame 12 (5) term "visible from earth" shall be omitted also.

6. Omit the faded position of the new moon.

7. The part of the crescent moon showing by earth light should be a gray tone rather then blacker than sky for more realism.

8. Leave dotted lines representing orbit.

B. Caption shall be changed. A little more than three days after the new moon we see a thin sliner of the lighted side, with the rest dimly showing by earth light. It is a CRESCENT moon (FSR frame 18).

Frame XIV. Omit this frame entirely from FSR as it will not be needed being replaced by FSR frame 16.

Frame XV.

A. Pictorial - Pictorial changes shall be the same as one through six of the FSO frame (12).

7. Use dotted lines to show path the moon has traveled since the new moon position.

8. Insert date of Sept. 1st on new moon position.

9. Insert date of Sept. 7th at the half moon position.

10. Add words "one week" on dotted orbital line.

11. Omit black half of the half moon.

12. Insert arrows to show movement from new moon to half moon.

13. Omit 1/4 fraction and FIRST QUARTER.

B. Change caption to the following: About one week after new moon we see 1/2 of its lighted side in the south at sunset. It is at FIRST QUARTER one fourth of the way around the earth. (FSR frame 19).

Frame XVI
(FSO)

A. Pictorial changes shall be the same as one through six in FSO frame 12 as well as adding under the gibbous moon the term WAXING in parentheses.

B. Verbal caption shall be the same as FSO frame 16.

Frame XVII
(FSO)

A. Pictorial changes shall be the same as changes one through six in FSO frame 12.

7. Inserting the date Sept. 1st in the new moon position and the date Sept. 15th under the full moon as it appears on the opposite side of the earth.

8. Omit the label SECOND QUARTER.

9. Omit 1/4 fractions.

B. The verbal caption shall be changed to the following: A little more than two weeks after the new moon, all of the lighted side faces us. The moon is FULL. It rises at sunset and sets at sunrise.

Frame XVIII.
(FSO)

A. Pictorial changes shall be the same as one through six in FSO frame 12 and put the word WANING in parentheses.

B. Verbal caption shall be changed to the following: After the full moon the moon wanes, rising after sunset, setting after sunrise. It is GIBBOUS again but now the flatter side faces toward the sun. (FSR frame 22).

Frame XIX.
(FSO)

A. Pictorial changes shall be the same as one through six as in FSO frame 12.

7. Omit THIRD QUARTER.

8. Omit 1/4 fractions.

B. Verbal captions shall remain the same as in FSO frame 19.

Frame XX.
(FSO)

A. Pictorial changes shall be the same as one through six in FSO frame 12.

B. Verbal caption shall be changed only by interchanged word "orbit" with the word "cycle" in FSO.

Frame XXI.

A. Pictorial changes shall be to remove the "one moonth" - one moon - one month from the top of scene.

B. Verbal caption shall be changed to the following: People used to measure months from FULL MOON to FULL MOON and called them moons. Our present calendar months no longer match the moon months. (FSR frame 25).

Frame XXII. There will be no pictorial or verbal changes in this frame. (FSR frame 26).

Frame XXIII. Delete this frame entirely from FSR.

Frame XXIV.

A. Pictorial changes

1. Remove artistic moon with labels of seas and replace it with a telephotograph bearing no labels.

2. Changed printed material to white letters.

B. Change verbal caption as follows: You can see in this telephotograph that the dark patches are lowlands and the light patches are highlands with mountains and craters. (FSR frame 27).

Frame XXV.

A. Pictorial changes

1. Change the moon positions to eight instead of four.

2. Draw a solid line around the outside and use the words - ONE REVOLUTION. Put arrows on the line pointing counterclockwise.

3. Make arrows in the moon's dotted orbit line more prominent.

B. Change verbal caption to the following: We see only one side of the moon because it rotates on its axis in the same period of time that it revolves around the earth. (FSR frame 28).

Frame XXVI. There will be no pictorial or verbal changes in this frame. Detain FSO frame. (FSR frame 29).

Frame XXVII.

A. Pictorial changes remain as in FSO except an arrow pointer should indicate the terminator in the photograph. It could be drawn from underneath the word terminator in the caption portion.

B. Verbal caption changes:

1. Substitute "This is the crescent moon" for the phrase "The crescent moon".

2. The remainder of caption shall be the same as FSO. (FSR frame 30)

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Frame XXVIII.

A. The Pictorial shall remain the same as FSO.

B. Verbal caption changes:

   1. Substitute "This is the gibbous moon" for the phrase "The gibbous moon".

   2. The remainder of caption shall be the same as FSO. (FSR frame 31)

   3. Leave a space between the sentence "This is the gibbous moon and rest of caption.

Frame XXIX.

A. The pictorial shall remain the same as FSO.

B. Verbal caption change will be as follows:

   1. Add the word "appears" (to shine directly down on the moon).

   2. Leave a space between the phrase "The full moon and rest of caption.

Frame XXX.

A. Pictorial change will be to add an arrow to point out which crater is Capernicus.

B. The verbal caption shall remain as in FSO.

Frame XXXI.

A. Pictorial change will be to add an arrow to point out the mountain ranges.

B. Verbal caption shall remain as in FSO.